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ETHNOLOGY.—*The antiquity of the Northwest coast totem pole.*[1]

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The problem of the antiquity of the so-called "totem pole" on the Northwest coast is not a simple one, and yet it is of importance from several points of view: for interpretations of art history of the area; and for appraisals of interareal relationships as well. Barbeau has in various papers assembled evidence which he interprets as indicating the very recent inception of the complex. Other writers have been influenced by his conclusions: Herskovits, for instance, in a discussion of cultural dynamics in his recently published work, was led by Barbeau's view to cite the Northwest coast totem pole as a particularly neat example of a historically documented product of acculturative influences deriving from European contacts.[2] Likewise, Quimby, in a well-considered appraisal of sources and types of extraneous influences on Northwest coast culture during the period of the maritime fur trade, weakens his position slightly by citing the debatable point of historic period origin of the totem pole as a fact along with the far more certain developments he points out.[3] As far as Quimby's thesis is concerned, this one item is of slight importance; the significant points he himself develops as to varieties of racial types and sources of cultural influence are for the most part beyond dispute. However, because of this dangerous tendency for interpretations to be accepted as proved facts, it seems important to point out available evidence that suggests a conclusion quite different from Barbeau's. The aim of the present paper will be to review critically what information can be assembled on the problem.

Barbeau's views as to the recent (historic) beginnings of the art of carving the totem poles on the northern Northwest coast are pretty well summarized in one of his earlier discussions of the problem:

> The art of carving poles is not really as ancient as is generally believed. Its growth to its present proportions is largely confined to the nineteenth century, that is, after the traders had introduced European tools, the steel ax, the adze, and the curved knife, in large numbers among the natives. The lack of suitable tools, wealth, and leisure in earlier times precluded the existence of elaborate structures. The benefits that accrued from the fur trade, besides, stimulated ambitions and rivalries between the leading families. Their only desire was to outdo the others in wealth and the display of prestige. The totem pole became, after 1830, the fashionable way of showing one's power and crests, while commemorating the dead or decorating the houses. The size of the pole and the beauty of its imagery published abroad the fame of those it represented.[4]

That is really a pretty moderate statement especially if the phrase "its growth to its present proportions" is stressed, for few persons familiar with Northwest coast culture of the historic period would deny that the tall carved poles, with their in-

[1] Published by permission of the Smithsonian Institution. The writer wishes to express his thanks to the director of the Massachusetts Historical Society, Boston, and the director of the Peabody Museum, Salem, Mass., for permission to examine and utilize materials from the invaluable records in the archives under their charge. Received October 12, 1948.

[2] M. J. HERSKOVITS, *Man and his works:* 480–481. New York, 1948.

[3] GEORGE QUIMBY, *Culture contact on the Northwest coast, 1785–1795.* Amer. Anthrop. n. s., 50: 247–255 (254). 1948.

[4] M. BARBEAU, *Totem poles of the Gitksan, Upper Skeena River, British Columbia.* Nat. Mus. Canada Bull. 61 (Anthropological Ser. no. 12): 12. Ottawa, 1929.

volved, stylized, but powerful motifs, became most abundant after 1830, just as Barbeau says, as one of the results of the breakdown of native social patterns brought about on the one hand by the decimation of population (from disease and from increased efficiency of intergroup warfare due to introduction of firearms) and on the other by the enormous influx of new riches brought about by European trade. We know fairly certainly that the pole complex spread southward to Coast Salish territory during historic times.[5] Yet elsewhere Barbeau indicates that he believes the entire complex of carving poles must have come into being since the "day of the early circumnavigators, that is, after 1778"[6] and points to a possible source of influence in the "Kanakas" (whom he describes in a footnote as "Slaves or serfs from the Sandwich Islands who were used in fairly large numbers by the ancient traders," doing something of an injustice to the adventurous spirit that led many Hawaiians to ship aboard the trading vessels to see something more of the world):

> We may wonder whether the insertion of abalone pearl segments as decoration for wood carvings—and this is a notable feature of many of the finest Haida, Tsimsyan, and Tlingit carvings—is not to be traced to this source, since the large, deep sea, shells themselves, from which they are cut, were imported, so we understand from the south sea in the course of transoceanic trade.[7]

And in another place he states:

> . . . we may draw the attention of the reader to the close similarities existing between the plastic arts of the North West Coast and those of various people around the edges of the Pacific ocean. An instance will suffice here. The early navigators noticed, about 1780–1790, the striking resemblances between the fortresses of the Haidas, the Kwakiutl, and other coast natives, to the *hippah* of the New Zealand natives. The totem poles, *as fairly recently carved and erected* on both sides of the Pacific, offer the same compelling evidence (*See* Plate XXX figures 2–5 [reference is to figures showing Northwest Coast totem poles and Maori carved poles and house entry-posts, the latter reproduced from Best's "The Pa Maori, New Zealand." PD]). The technique for their erection was also identical (*See* Plate XXXI, figures 1, 2) [figures showing strikingly similar methods of raising a tall pole, from Tsimshian and Maori. PD].[8]

There appear to be several flaws in the argued derivation from "Kanaka" sources, to which we shall return later on. More important is the line of reasoning that Barbeau follows in arriving at his conclusions. One of his basic points is that totem poles are not described in the accounts left by early European and American explorers. The other is that while aboriginal tools may have sufficed for the carving of small objects, massive carvings such as those of the totem poles were not practicable until the introduction of iron and steel tools by the maritime traders. The reader is in something of a quandary, in regard to the first point, when he reads the quotations from Bartlett and Fleurieu that Barbeau himself cites, describing tall elaborately carved entry-poles of Haida winter houses in the vicinity of Cloak Bay, seen in 1791.[9] It appears, however, that Barbeau draws a distinction between the detached memorial poles, which are his "totem poles," and carvings which were integral parts of the houses, such as the carved house posts, and the entry or frontal-poles that contained the doorway by means of which one entered the house. We may perhaps grant him the distinction between carved house *posts*, and the much taller memorial and entry-poles, carved with multiple figures, but to separate the memorial or commemorative poles from the entry-poles rather vitiates his argument as to the necessity for iron or steel tools for the carving of the former. While from the functional point of view the two varieties of tall carved poles may have been distinct, they were stylistically alike, and one type in-

[5] H. G. Barnett, *The southern extent of totem pole carving.* Pacific Northwest Quarterly 33: 379–389. 1942.

[6] M. Barbeau, *Alaska beckons:* 248. Caldwell, Idaho, 1947.

[7] Barbeau, 1929, p. 24. "Kanaka" influence is also stressed in Barbeau's paper *The modern growth of the totem pole on the Northwest coast.* Journ. Washington Acad. Sci. 28: 385–393. 1938. (Also in Smithsonian Inst. Ann. Rept. for 1939: 491–498. 1940.)

[8] Barbeau, 1929, pp. 26–27.

[9] Op. cit., pp. 16, 17. The Bartlett drawing is in a manuscript in the possession of Col. L. R. Jenkins, Director of the Peabody Museum, Salem. It has been published in E. Snow's *The sea, the ship, and the sailor,* Salem, 1925.

volved no more labor than the other in its execution. It is worth noting that the distribution of the entry-pole, set against the outside of the house with the open mouth of a huge figure forming the doorway, had a rather wide if sporadic distribution (and the sporadicity may be due in part to incompleteness of our information from the early historic period). In addition to its occurrence among the Haida,[10] it is reported by a number of observers among the Central Nootkan Clayoquot: Meares, in 1788, and Haswell and Boit, in 1799, were all impressed by the Clayoquot portal pole in "Wikannannish's" house.[11] Haswell's peculiarly punctuated but graphic description of the Clayoquot village is worth quoting:

> Their Towns are larger and much more numerously inhabited than those of the Sound (i.e., Nootka Sound. PD) they are better bult. And are cleaner their Clumas or carved pillers are more numerous and better exicuted some of these are so large that the Mouth serves as doarway into their houses some of their ridgpoals which are of incredable length and bulk are neatly Fluted others are painted in resemblance of various sorts of beasts and birds we met with resemblences of the Sun both painted and carved the rays shoot from every side of the orb which like our Country Sign painters they pictur with eyes nose and mouth and a round plump face.[12]

In addition to the fact that the memorial poles and the entry-poles must be accounted as essentially the same, technologically, at least, there is the fact that memorial poles themselves are reported from several localities during the 1790's. Barbeau himself quotes a passage from Ingraham's *Journal of the Hope* in which Ingraham relates that he went to see "2 pillars in front of a Haida village . . . about 40 feet in height, carved in a very curious manner, indeed, representing Men, Toads, etc. . . . "[13] There can be little doubt that these were totem poles of the same type as those erected in the middle of the 19th century. Fleurieu refers somewhat vaguely to "monuments in honor of the dead" seen at several Haida villages, but does not make clear whether these are the "mausolea or tombs" he described elsewhere (platforms on top of 10-foot poles, and boxes "wrought with art" supported on four short posts).[14] At Lituya Bay, in 1793, the Malaspina expedition saw, and the artist Tomas de Suria sketched, a huge mortuary carving, very clearly representing a grizzly bear, set up alongside of some elaborately carved mortuary boxes raised on poles.[15] In 1794 there occurred the interesting circumstance of a trading ship captain's assisting a Haida chief in setting up a memorial pole. The captain was Josiah Roberts, of the ship *Jefferson*, out of Boston; the Haida chief was "Cunneah," a well-known personage among the maritime traders of the day, whose village was situated on North Island, on Parry Passage. Howay has summarized the very interesting journal of this voyage, which was kept by Bernard Magee, the first officer.[16] Thanks to the courtesy of the director of the Massachusetts Historical Society, where the original manuscript journal is preserved, I was permitted to read and extract pertinent passages from Magee's account. They run as follows:

> [June 17th, 1794] . . . in the afternoon the Capt. with the Carpenters & some hands in the pinnace went to the village at the request of Cunneah to

[10] Marchand, Bartlett, and others have given us descriptions of tall Haida portal poles, elaborately carved, seen in the early 1790's. These descriptions, which Barbeau (1929) has reproduced in full, make clear that the objects were tall poles, not "posts through which a round mouthlike entrance had been cut," as Barbeau phrases it (1947, p. 235).

[11] Meares, quoted by Barbeau, loc. cit., p. 16; Haswell and Boit in: F. W. HOWAY, *Voyages of the Columbia*, Massachusetts Hist. Soc. Publ. 61, 69 pp. Boston, 1941.

[12] HASWELL, loc. cit.

[13] J. INGRAHAM, quoted in Barbeau, 1939, p. 496.

[14] FLEURIEU, quoted by Barbeau, op. cit., pp. 17–18, 203.

[15] This Suria drawing was noted some years ago by Wagner in a paper on Suria's journal (H. R. WAGNER, *The voyage of Tomas de Suria to the Northwest coast, 1791–1793*, Pacific Hist. Rev. 5: 234–276. 1936. The drawing appears in a publication of the Museo Naval de Madrid, 1932; it has recently been reproduced by Wolfgang Paalen in a very enlightened article on Northwest coast art published in the magazine DYN (no. 4–5, Mexico, 1943).

[16] F. W. HOWAY, *A Yankee trader on the Northwest coast, 1791–1795*, Washington Hist. Quarterly 21: 83–94. 1930. Barbeau, 1947, p. 250, apparently refers to this incident when he speaks of "a seaman named Jefferson" who helped the Haidas erect a carved pole.

plane and smooth a monumental pillar of wood—previous to its erection on the morrow—in the evening returned on board . . .

[18th] . . . in the morning I went in the pinnace with the Carpenters and 2 hands to the village took along with us 2 spair topmasts for sheers & sufficient Tackling to set up the pillar—which in the afternoon got in its place—after finishing the necessary requisites for its intended purpose of sepulture of a daughter of Cunneah's—I returned to the ship . . .

On the 19th, Cunneah and his wife invited Captain Roberts and his officers to the village. The captain, the ship's doctor, and the supercargo attended the mortuary potlatch. Cunneah gave each of the officers a sea-otter skin, the dead child's father (Magee seems to have erred in his statement of the relationship made the previous day) likewise made them gifts, and other chiefs followed suit. Cunneah then requested the captain to have the pole painted. This passage with the description of the potlatch has been published verbatim by Howay in his paper on the journal. Some days later, Magee was again sent by the captain to the village:

[July 8th] . . . in the afternoon I went to the village with some hands at the desire of Cunneah in the morning—to raise an image on the monument lately set up—which they cut and carved with a great deal of art—being the representation of some wild anemile—unknown to us—somewhat the resemblance of a tode . . .

Several interesting details may be remarked in this account in addition to the fact of the erection of a mortuary pole, which we may suppose to have been (and as a slightly later journal makes clear definitely *was*) a pole like the famous recent Old Kasaan Bear pole, with the addition of having a small excavation chopped out in the back to contain the dead child's body, Haida-fashion. We note that even in 1794, after some years of contact and trade in the Parry Passage vicinity, where nearly all ships that made the coast put in, the Indians, despite their appreciation of white carpenters' and riggers' superior techniques, had not acquired the manual dexterity to use the European tools, which of course require a completely different set of motor habits. As a matter of fact, ethnographic accounts show that the adz in one or another of its local forms remained in use until the latter part of the nineteenth century. It persisted despite the fact that for close work it is a much more laborious and a much slower implement than the plane and spokeshave. The same persistence of old tool patterns is documented at Nootka Sound, not far to the south, where white contact was even more intense than in Haida territory. Jewitt relates that during his enforced stay at Nootka, 1803 to 1805, the natives continued felling trees with their iron-bladed chisels, although it took several of them two or three days to fell a tree, chipping away around and around it beaver-fashion, that he and Thompson could have laid low in a few hours with their axes. And yet, being a practical people, the Northwest coast natives recognized the advantages of the superior tools it took them so long to get the knack of using.

It should be noted too, in Magee's account, that the initiative in the matter came from Cunneah; Captain Roberts simply had the base pole cut and "planed" and set up as the Haida chief wanted it done. Roberts's aim was clear. All he cared about was cultivating the chief's goodwill, in the hope of being given preference when the latter had furs for trade. The "wild anemile" figure that surmounted the post was carved by native craftsmen; certainly there is no intimation that the ship's carpenters had the least thing to do with it.

We are fortunate in having a description of this same pole from the pen of a more articulate writer than Magee. In 1799, the ship *Eliza*, Captain James Rowan, out of Boston, was trading along the Queen Charlotte Islands. On March 22 of that year, her ship's clerk, whose journal is preserved in the Massachusetts Historical Society archives, went ashore to spend the night at Cunneah's invitation.[17] The journal gives a lively sketch of Haida house-life, as

[17] As Howay has pointed out (in the *Voyages of the Columbia*, p. 96, note 3. 1941), the attribution of this journal to William Sturgis is incorrect. Sturgis was first officer of the *Eliza* on this voyage, and his log is in the same archives, but it is a real deck log—his "Remarks" columns contain almost nothing but winds, sails set, depth of water and type of ground at anchorages, and the like.

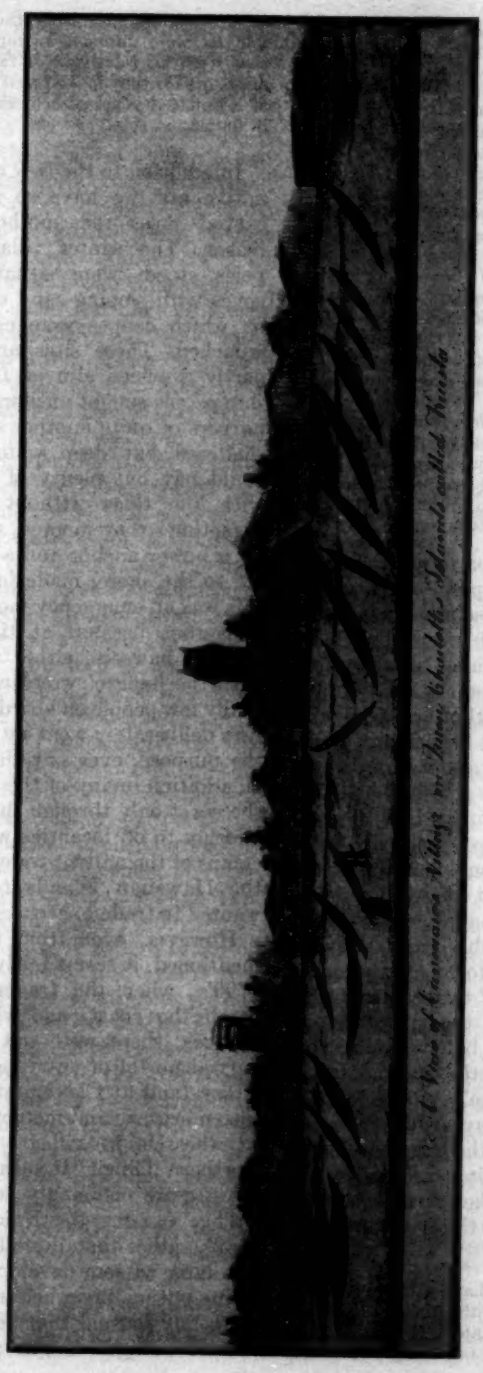


FIG. 1.—View of "Cunneaw's" village, from the journal of the ship *Eliza* (1799). Reproduced through the courtesy of the Massachusetts Historical Society.

witnessed on that occasion, then under the date of March 23, goes on to say:

> In the morning I rose early to examine the village, and take a sketch of it . . . [this sketch s reproduced in Fig. 1 of the present paper. PD] the village consisted of 8 houses of which Cunneaws was the largest, being about 50 feet long, 30 broad and 15 to the rise of the roof. to the peak of it I suppose was about 22 or 3 feet. At the right hand of the village as you go to it were a number of wooden structures raised I suppose over the bodies of their dead chiefs. some were exactly like a gallows, some a solid square piece of timber about 15 feet high on which were carved the figures of men and children. but the only thing I saw which had any idea of proportion, was a Pillar by the side of Cunneaw's house on top of which was a figure intended to represent a bear; the figure and Pillar were both painted red with Ochre. the teeth, eyes, nostrils, and the inside of the ears (which were stuck forward) of the animal were made of mother of Pearl shell; which gave it a very beautiful appearance, in comparison to what North West Sculpture generally has . . .

This pole, consisting of an animal figure surmounting a straight plain shaft, alongside the same chief's house, must have been the one Magee told of, even though he thought the "wild anemile" figure represented a "tode." His remark that it was "carved with a great deal of art" is significant. In other words, the bear figure, which called forth both men's admiration, was a pretty gaudy, not to say garish, item. This fact, together with the utter lack of comment on the other carved poles by most writers (and the very casual mention by the writer of the journal just quoted), suggests that the few data we have on Northwest coast carving from the early historic period are more justly to be attributed to the poor artistic taste of the seafarers than to the nonexistence of the sculptures at that time. A few days before the writing of the above passage, the journal has a description of "Altatsee's village of Tatanee," near Cloak Bay, which, we are informed, "consisted of the large Number of two Houses . . . " Going ashore in the evening, the keeper of the journal spent the night, and then, under the date of March 11, relates:

> I rose at daybreak and having taken a sketch of the two houses, to save the length of description [this sketch unfortunately is missing from the journal. PD], and seen two images that were at a short distance from them which Altatsee told me were intended to represent two Chiefs, that were his relatives (or rather they were his ancestors for they looked as if they were upwards of a hundred years of age) that had been killed in battle . . . (etc.)

In addition to the lack of appreciation of native art, we have so few mentions of carved poles for another very obvious reason. The winter villages, where such poles stood, were situated in sheltered coves with sloping sand or gravel beaches on which canoes were easily landed and launched. These sites are often actually partly drowned alluvial fans. The sailing-ship people sought anchorages in coves and harbors of quite another sort: they needed sheltered but deep water, so that they could pay out plenty of cable and swing with the tides without going aground. Sometimes they moored, of course, usually by a bower anchor and a hawser run from aft to the shore, made fast to a tree, but this was an emergency measure, really, and dangerous because at times the Indians cut the hawsers, either to steal them or with the hope of wrecking the vessel. Actually few people on board, aside from those who deliberately went by boat or canoe for the purpose, ever saw the winter villages. In addition, many of the traders stayed on the coast only through the summer season, and lay to off localities where the summer camps of the natives were, running down to the Hawaiian Islands to winter if they wanted to trade a second season.

However, even from the few accounts mentioned, it seems fairly clear that in the 1790's, when the traders first began to comb the coast, and visited the winter villages, there were not only elaborately carved portal or entry poles in Haida territory (and at Clayoquot), but there were also mortuary and memorial poles standing at the Haida villages and among the northern Tlingit. It seems that such poles were more commonly to one side of the village (among the Haida and at Lituya Bay), rather than directly in front of it, as the later custom developed, but they were being put up, nonetheless. I am not familiar with any journal that describes Tsimshian winter villages of this period. The *Eliza*

appears to have been one of the first trading vessels, if not the first, to trade with the Nisqa up Observatory Inlet, but her people never went up the mouth of the river to the village and have left no description of it.

There is another line of evidence concerning use of memorial poles which may be considered. De Laguna has recently traced use of such features—most of them are, to be sure, less ornate than those of the northern Northwest coast, but many of them involved some carving of simple figures, and/or painting—from as far south as the Columbia River Basin northward along the coast to southwest Alaska and down the coast of northeast Asia.[18] On the basis of such a distribution, the Tlingit-Haida-Tsimshian memorial pole complex (and the intimately related entry-pole pattern) would seem to be but a local intensification and elaboration of what has all the earmarks of a moderately old trait.

To return a moment to the question of "Kanaka" influence on Northwest coast art, it is necessary to consider the route of the English and American traders. After beating their way around Cape Horn they sometimes put in for wood and water at islands off the South American coast. The Americans were a little chary of doing this, the English dared not, for their ships were sure to be confiscated and they themselves interned by the jealous Spanish authorities. Whether they put in there or not, however, they stood for the Hawaiian Islands running before the Southeast Trade Winds, where they were sure of plenty of water, fresh stores, and wood. Many ships that planned to spend several seasons trading on the Coast ran down to the Islands to winter. By and large the traders maintained good relations with the Hawaiians, being very conscious of the latter's numbers and warlike proclivities—besides those natives had no treasures by which the traders might be tempted. The captains soon learned that when they were short a hand or two, replacements could be recruited easily (very early in the trade, a chief's son who wanted to see the world was taken to the Coast, to China, and back to Hawaii, which may have set a precedent), and the Hawaiians seem to have made good hands. We know that several Hawaiians made more than one voyage to the Northwest coast, for at times they acted as interpreters between Indians and whites.[19] Yet there seem to be no records—at least I know of none—of Maori being taken to the Northwest coast. Yet the Maori carved portal poles and carved house fronts are the ones whose similarity to Northwest coast totem poles is pointed out by Barbeau; the Hawaiians, so far as we know, did no such elaborate monumental carving.

The use of abalone-shell inlays is more easily understood as the transfer of the inlay technique from sea-otter teeth and the opercula of a sea snail, which was noted by the earliest voyagers on the Northwest coast,[20] to a new and attractive material. The shells themselves seem to have been imported from California by the Spanish—not from the "South Seas"—they are usually referred to in the accounts as "Monterrey shells."

Barbeau also brings up the question of Russian influence on the Northwest coast at a very early period.[21] That too is a doubtful point. The Russians were in "Alaska" by the middle of the eighteenth century, but the part of Alaska they were in is a long way from the Northwest coast. They were reaping a golden harvest in *southwest* Alaska, and so far as available records go made no attempt to cross the Gulf of Alaska until well along in the 1790's (establishing a short-lived post at Yakutat 1796 and an ill-fated fort near Sitka, in 1799). Native trade along this wide unfriendly reach of coast did occur—as witness the Cross Sound atlatls, Aleut in type carved with Tlingit designs, and the *umiak*, perhaps Chugachmiut in origin, seen at Port Mulgrave by La Perouse,[22] but there is no

[18] F. DE LAGUNA, *The prehistory of northern North America as seen from the Yukon*. Soc. Amer. Arch. Mem. 3 (Suppl. to Amer. Antiquity 12: no. 3), pp. 90 ff. 1947.

[19] QUIMBY, 1948, refers to a number of cases of Hawaiians who shipped to the coast.

[20] Cf. JAMES COOK, *Voyage to the Pacific Ocean* (etc.) 2: 327.

[21] BARBEAU, 1929. p. 22.

[22] The atlatls are figured by O. M. DALTON, *Ethnographic collections from the northern coast of North America*. Internat. Archiv für Ethnogr.

evidence that such trade occurred on a scale sufficient to account for the abundance of iron on the Northwest coast as having simply been passed on from the Russian establishment on Kodiak Island. After all, Nootka Sound is many miles and a multitude of hands, in hand to hand exchange, from Kodiak Island, and it was at Nootka that Cook saw iron-bladed tools to the practical exclusion of all other forms. There is no evidence, in short, that the Russian influence on Tlingit and other Northwest coast tribes was of any importance until the very end of the eighteenth century, by which time the natives had learned a smattering of English and had acquired vast quantities of American and British-made trade goods.

Nor can trade from Hudson's Bay Company posts be considered a very likely source. For one thing, in Cook's time, and for some years, the nearest Hudson's Bay post was many days' travel inland, to the east of the Rockies. For another, the types of the iron implements themselves—the heavy-bladed, rapidly tapering daggers (on the northern coasts, at least, double-pointed ones were in vogue at the time of first European visits) and the well-known curved knives—do not appear to have been forms made and traded by Hudson's Bay Company. And finally, if any coureur de bois who had any contact with outlying Hudson's Bay posts had ever crossed the mountains, Mackenzie, who was a practical as well as a bold explorer, would surely have got information that would have saved him many of the painful mistakes he made on his heartbreaking "journey to the Pacific Ocean."

It seems evident, in short, that the source of Northwest coast iron tools can not be attributed either to Russian or to Hudson's Bay Company sources but must have lain in some earlier iron-using contact, from which the precious pieces came along well-established trade channels, dribbling slowly down the length of the coast. One is tempted to suggest some late (A.D.) Siberian "Iron Age" culture as a source, despite present lack of knowledge of the eastward extent of such cultures. Collins has discussed in some detail the most likely source of the iron found in the Punuk horizon of western Eskimo culture; the metal made its appearance at the beginning of that period, more than a thousand years ago.[33] Iron from the same Asiatic source may have been transmitted along a route that eventually brought it to the natives of the Northwest coast in ancient times. That iron from a non-European source was in use in the Alaska Peninsula at the beginning of the historic period is made clear by Steller's remarks concerning the iron knives carried by the natives he saw on the Shumagin Islands in 1741. He states:

> From the distance I observed the nature of the knife very carefully as one of the Americans unsheathed it . . . . It was easy to see that it was of iron, and, besides, that it was not like any European product.[34]

The persistent tradition among Northwest coast natives that their forefathers first obtained iron from timbers containing spikes or bolts or other fittings that drifted up on the beach—presumably timbers of wrecked vessels—has suggested to some writers that this material may have come from junks—Chinese or Japanese—swept from the Asiatic coast by the Japanese Current. The possibility of such craft reaching the Northwest coast periodically, with iron implements aboard, and perhaps survivors of their crews to teach the use of them, can not be dismissed. We have not only the evidence of the Japanese glass net floats, and more recently, mines, that drift ashore in quantities on the outer beaches from the Queen Charlotte Islands to the Oregon, and perhaps northern California coasts, but there is the well-documented incident of the Japanese junk

10: 227–245, pl. 15. 1897. C. H. READ, *Account of a collection . . .*, Journ. Roy. Anthrop. Inst. 21: 99–108, fig. 3, 1891. A. P. NIBLACK, The Coast Indians of Southern Alaska . . ., U. S. Nat. Mus. Rept. for 1888, pp. 225–386. 1890. The umiak is described and figured by La Perouse, *Voyage autour le monde . . .*, 1: 390. Paris, 1797.

[33] HENRY B. COLLINS, JR., *Archeology of St. Lawrence Island, Alaska*. Smithsonian Misc. Coll. 96, no. 1, pp. 304–305, 329. 1937.

[34] STELLER, in F. A. Golder, *Bering's voyages*, Amer. Geogr. Soc. Research Ser. No. 2, 2: 97. 1922.

wrecked on Cape Flattery with three crewmen still alive.[25] Or perhaps both these possible sources were involved, including the Siberian Iron Age one.

This discussion seems to have gone pretty far afield from its avowed theme of Northwest coast totem poles. Yet all the facts are pertinent. Even if the hypothesis is allowed that the origin of Northwest coast art was intimately linked with the use of metal tools, it is not necessary to assume that these tools, and the beginnings of the art style and even its maximum expression in the great carved poles, must be dated after the period of first European contacts in the closing decades of the eighteenth century. Three separate sets of facts indicate that Northwest coast art, and the carving of totem poles themselves, antedated all European influences in the area. First, not only small objects carved in best Northwest coast style but totem poles themselves were seen by the first Europeans who had the curiosity to go visit the winter villages where such poles might be found, in northern Tlingit country, among the Haida, and in a related form, among the Nootkan Clayoquot. Second, these poles, or at least the poles in their memorial function, seem to represent an elaboration of a burial complex involving use of memorial poles set up by the graves that extended from the Northwestern United States clear around the Pacific rim into northeastern Asia. And finally, even if such carving was dependent on the use of iron (as of course can not be conclusively proved), it seems most probable that the tribes of the Northwest coast obtained their iron from some Asiatic source long before the entry of Europeans or Russians into the North Pacific.

[25] C. M. DRURY, *Early American contacts with the Japanese.* Pacific Northwest Quarterly 36: 319–330. 1945.

However, despite Quimby's statements (1948, p. 247), there are no known records of Japanese reaching the coast during the period of the maritime trade, let alone before. As for timbers with iron in them, however, wrecks of junks seem doubtful possibilities. At least it is my understanding that one of the characteristics of junks, in addition to their bluff lines, shallow keels, and lug sails, is the lack of metal involved in their construction. For iron-bearing timbers the best possibility would seem to be wreckage from the occasional lost "nao de Manila"—the galleons that plied between Manila and Acapulco beginning nearly two centuries before Cook stood in to Nootka Sound.

ARCHEOLOGY.—*Early cultural manifestations exposed by the archeological survey of the Buggs Island Reservoir in southern Virginia and northern North Carolina.*[1] CARL F. MILLER, River Basin Surveys, Bureau of American Ethnology, Smithsonian Institution. (Communicated by MATTHEW W. STIRLING.)

During the months of February through April 1947, three governmental agencies, the Corps of Engineers, the National Park Service, and the Smithsonian Institution conducted an archeological survey of the area to be flooded by the Buggs Island dam. The dam is being constructed 178.7 river miles above the mouth of the Roanoke River in Mecklenburg County, Va., about 20.3 miles downstream from Clarksville, Va., and 18 miles upstream from the Virginia–North Carolina boundary, taking in part of Mecklenburg, Halifax, and Charlotte Counties in Virginia and Warren, Vance, and Granville Counties in North Carolina.

The Roanoke River rises on the eastern slopes of the Appalachian Mountains, flows in a southeasterly direction toward the Atlantic coast, and empties into Albemarle Sound, N. C. The principal tributary, the Dan River, rises in Patrick County, Va., flows into North Carolina, and ultimately returns to Virginia where it enters the Roanoke at Clarksville. A small portion of the drainage basin lies in the rugged terrain of the Allegheny and Blue Ridge Mountains, the remainder is in the Piedmont Plateau. The latter is a rolling to hilly country with elevations ranging from 300 to 900 feet above mean sea level. The river channel varies in width from 100 feet in the upper to about 800 feet in the lower reaches.

Ninety-four sites were listed by the

[1] Received September 2, 1948.

survey, these comprising 34 village sites, 17 camp sites, 41 flint work shops, and 2 historic iron-working sites. In addition, eight other sites were located outside of the reservoir proper, which will be affected by the reservoir action.

The survey shows that most of the inhabitants preferred to settle on the bottom lands usually on ground high enough to afford enough drainage yet close to the river or its tributaries. It is upon the hills away from the streams that the oldest manifestations were found. No mounds were noted within the Basin.

Evidence gathered during the survey points to two main cultural horizons, an extremely early culture characterized by an eastern variant of Folsom, as distinguished from the true Folsom found in the western part of the United States, and accompanying groups, besides a very much later pottery-making group. Evidence of early man is not new, as former workers have noted his remains in Virginia and other parts of the East. Large numbers of points (Fig. 1, *a–d*) attributed to the eastern variant of Folsom have been noted as coming from this particular section of Virginia and North Carolina. The possibility of two Folsom camp sites within the basin makes the area more interesting.

In the interval between the Folsom occupation and the later occupants of the area, it seems that other early groups were present. This evidence occurs in the form of projectile points having characteristic outlines, peculiarities of chipping—readily recognized out of context, and are comparable to a number found in sites in the western part of the United States.

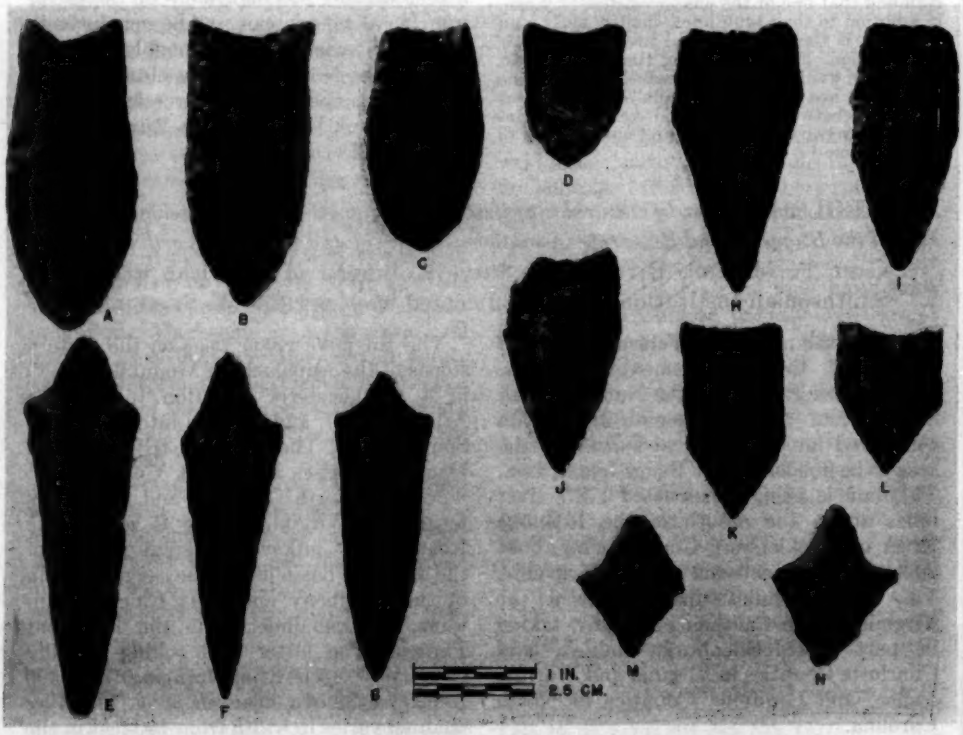


FIG. 1.—Types of early projectile points from the Buggs Island Reservoir: *a–d*, eastern variant of the Folsom; *e–g*, Gypsum Cave; *h–l*, pentagonal; *m*, *n*, Manzano points.

Harrington[2] in his exploration of the Gypsum Cave in Nevada located a number of points attributed by him to early occupants of the cave and were called Gypsum Cave points. These resemble a number of points, similar in outline and chipping, found in southern Spain and assigned to the Solutrean Period. Points resembling these were recovered from the surface of sites in the Buggs Island basin; the best of these are shown in Fig. 1, *e–g*.

Hibben,[3] while excavating a cave in the Manzano Mountains in New Mexico, found another distinctive type of point which he attributes to early man in that section. Similar points (Fig. 1, *m*, *n*) were recovered from the surface of a site in the Buggs Island basin. These points resemble those found by Harrington at Gypsum Caves with the exception that the Manzano specimens seem to have considerably more flare and definition of shoulder and apparently can be assigned to the same relative period, that is, later than Folsom. In this case the makers of this type of point came into southern Virginia and northern North Carolina at a time when Folsom points were no longer manufactured and possibly when Folsom man had vacated this section of the country.

Various pentagonal types are found associated with the eastern variant of the Folsom which show fluting and comparable base treatment. These are best illustrated by types *h*, *i*, *j*, *k*, and *l*, of Fig. 1.

Apparently there was a time, after these early occupants, when no settlements were established in the area. At a much later date a possible prepottery group infiltrated and occupied certain sections of Virginia and North Carolina which in turn were followed by pottery-making groups whose culture compares favorably with that of the Watts Bar and Candy Creek Foci of Tennessee.

At the time of the coming of white man a Siouan group is reported to have occupied the Occaneechi Island at the confluence of the Dan and Roanoke Rivers. This site was abandoned before or about 1700 for in 1701 they were reported to be occupying sites in northern North Carolina.

The archeology of this section of the East is practically unknown, and until actual excavation of the various sites has been accomplished and a thorough study of the data obtained, no definite tie-in with known cultures can be made.

[2] HARRINGTON, MARK RAYMOND, *Gypsum Cave Nevada*. Southwest Museum Papers, no. 8. 1933.
[3] HIBBEN, FRANK C. *Evidences of early occupation in Sandia Cave, New Mexico, and other sites in the Sandia-Manzano region*. Smithsonian Misc. Coll. **99** (23). 1941.

ENTOMOLOGY.—Simulium virgatum *Coquillett and a new related species* (*Diptera: Simuliidae*).[1] ALAN STONE, U. S. Bureau of Entomology and Plant Quarantine.

Since considerable confusion exists as to the identity of the simuliid fly *Simulium virgatum* Coquillett, this paper is offered to facilitate determination of the species and to describe a closely related new species that has been confused with it. The species here treated fall into the subgenus *Dyarella* Vargas, Martínez, and Díaz (1946) (type, *Simulium mexicanum* Bellardi), and this paper deals with the only two species of the subgenus now known from the United States. This subgenus may be diagnosed as follows:

Usually rather large species; antenna with 11 segments; anterior veins of wing with both hairs and spines; vein R with or without setae; radial sector not forked; vein Cu_2 curved; postnotum without pilosity; hind basitarsus with a well-developed calcipala; second hind tarsal segment with a distinct pedisulcus; each claw of hind tarsus of female with a subbasal tooth; anterior gonapophyses of female genitalia large, their inner margins subparallel; paraprocts small; dististyle of male genitalia large and somewhat flattened, not more than 3 times as long as wide with no basal process but with lateral margin sinuous.

The species of this subgenus are not known to attack man, but several have been found feeding on horses.

[1] Received October 8, 1948.

The references given in this paper are by no means complete, only those of real significance being listed.

Simulium (Dyarella) virgatum Coquillett

Simulium virgatum Coquillett, Proc. U. S. Nat. Mus. **25**: 97. 1902 (♀, ♂); Dyar and Shannon, Proc. U. S. Nat. Mus. **69**(10): 39, figs. 82, 83, 126, 127, 128. 1927 (♀, ♂); Fairchild, Ann. Ent. Soc. Amer. **33**(4) 718, figs. 5, 7, 32. 1940 (♀, pupa); Stains and Knowlton, Ann. Ent. Soc. Amer. **36**(2): 274, fig. 75. 1943 (♀ only).

Simulium hippovorum Malloch, U. S. Bur. Ent. Tech. Ser. no. 26: 28, pl. 2, fig. 12. 1914 (♀).

Simulium rubicundulum Knab, Insecutor Inscitiae Menstruus **2**(12): 178. 1914 (♀); Vargas, Martínez, and Díaz, Rev. Inst. Salub. y Enferm. Trop. **7**(3): 105, 106, 111, 163, 179, figs. 132, 160. 1946 (♂, larva).

Simulium virgatum chiapense Hoffmann, [Mex.] Univ. Nac. An. Inst. Biol. **1**(4): 293–297, figs. 2, 9. 1930 (♀ pupa).

Simulium mathesoni Vargas, Rev. Inst. Salub. y Enferm. Trop. **4**(4): 360, figs. 39–43. 1943 (♂) (new synonymy).

Simulium virgatum may be distinguished from all of the species now placed in the subgenus *Dyarella* by the following diagnostic characters:

Male: Scutum with stripes, when viewed posteriorly the pale stripes broad and distinct to the prescutellar depression; wing at least 3.5 mm long; all hairs at base of costa dark. Genitalia: Adminiculum (Fig. 3) with a strong median projection from the posterior border nearly half as long as dististyle; lateral angle of adminiculum a rounded rectangle, the space between central process and lateral margin not strongly concave; dististyle (Fig. 5) when flattened with inner margin nearly straight, outer margin distinctly curved; distal spine very small.

Female: Scutum with distinct curved stripes; wing at least 3.5 mm long; hairs at base of costa on dorsal surface dark; tibiae rather broadly orange-brown medially, not mostly dark with a narrow subbasal pale ring. The female is not separable externally from *briceñoi* V.M. & D., or *hinmani* V.M. & D. Genital fork (Fig. 1) with strong inwardly directed tooth from each arm near base as well as a strong outwardly directed projection; handle with swollen knob at end; paraprocts with strong hairs confined to posterior margin.

Pupa: Respiratory filaments (Fig. 9) 8 (6 in two groups of 3, 2 single); dorsum of thorax smooth, not strongly reticulated. Cocoon (Fig. 7) with dorsal aperture surrounded by numerous projections connected distally.

Type data: *Simulium virgatum* Coquillett: 2 ♂ ♂, 2 ♀ ♀, Las Vegas Hot Springs, N. Mex. August 4 to 14 (H. S. Barber). U.S.N.M. no. 6183. The male, collected August 4 with the genitalia mounted on a slide and bearing the label "Type" and Coquillett's determination label, is here designated lectotype.

Simulium hippovorum Malloch: One female in ear of horse, head of Río Piedras Verdes, altitude about 7,300 feet, Sierra Madre, Mexico (C. H. T. Townsend). U.S.N.M. no. 15407.

Simulium rubicundulum Knab: Córdoba, Mexico, December 17, 1907, one ♀ (F. Knab); Las Vegas Hot Springs, N. Mex., August 7, one ♀ (H. S. Barber), U.S.N.M. no. 19112 The Córdoba specimen was selected by Dyar and Shannon (1927) as type. The other specimen is presumably one of the females of the type series of *virgatum*, only the specimen of *virgatum* here selected as lectotype having received a type label.

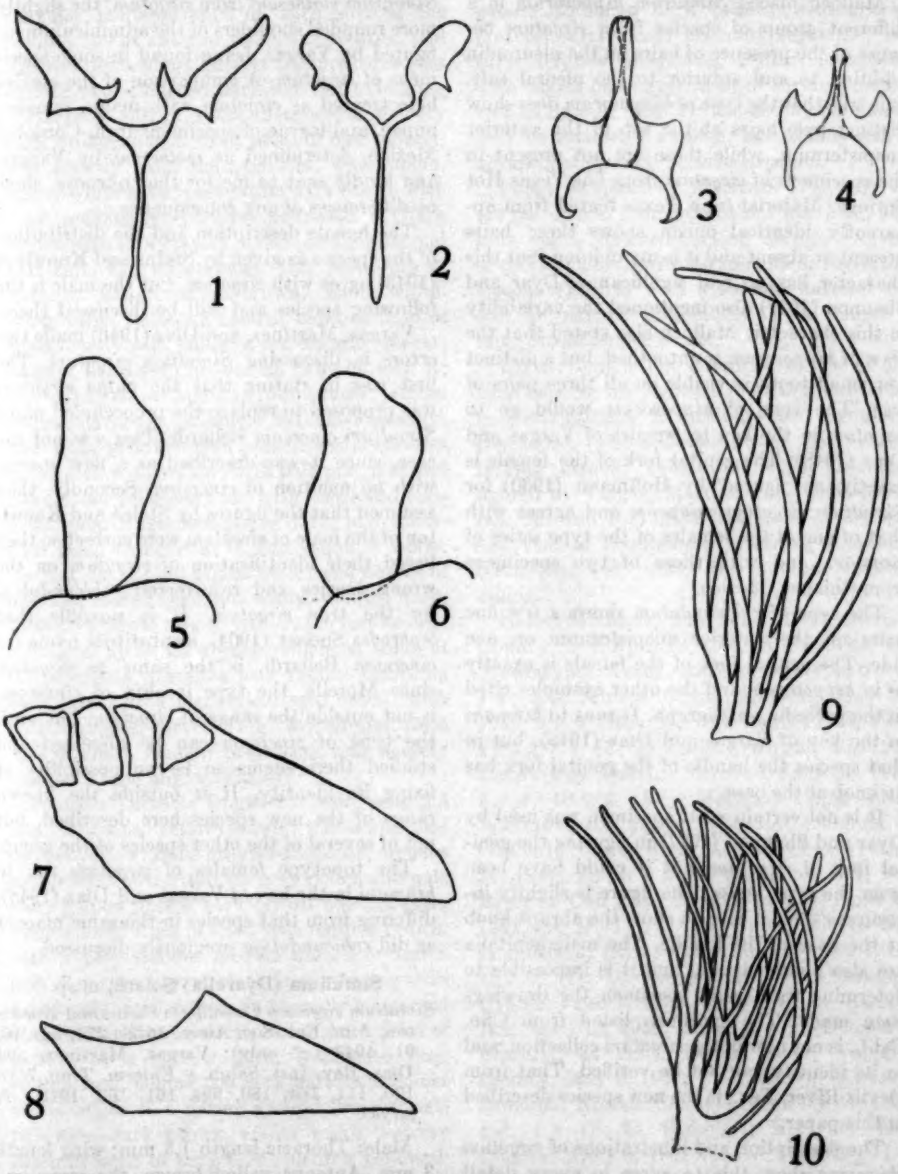
Simulium virgatum chiapense Hoffmann: Only the female originally described. As far as I can discover no lectotype has been selected for this nor is it certain where the original material is now. The pupal filaments of *virgatum* were first figured in this paper under the name *virgatum chiapense*.

Simulium mathesoni Vargas: Holotype male, 1,400–1,500 m elevation, November 21, 1943, Temixco, Morelos, Mexico (A. Martínez P.). Instituto de Salubridad y Enfermedades Tropicales, Mexico. In addition to the holotype two pupae were also described.

Distribution. *United States:* California: Alameda, Calaveras, Fresno, Lake, Los Angeles, Madera, Mariposa, Monterey, Napa, Placer, San Bernardino, San Diego, Santa Clara, Siskiyou, and Solano Counties. New Mexico: San Miguel County. South Dakota: Fall River County. Texas: Edwards, Medina, Travis, Uvalde, Williamson, and Zavala Counties. Utah: Grand, Utah, and Washington Counties. Washington: Yakima County. *Mexico:* States of Chiapas, Veracruz, and Chihuahua.

The above distribution is based only on specimens actually seen by me. Fairchild also reports it from Guatemala and Panama and Stains and Knowlton from Oregon. A recent

communication from Dr. Díaz N. lists the species under the name *rubicundulum* only from the states of Chiapas, Oaxaca, and Veracruz in Mexico. In view of the wide distribution of the species in the Western United States, it is strange that it has not been collected in the more northern states of Mexico. The extensive California records are mostly due to the col-



FIGS. 1–10.—*Simulium virgatum* Coquillett and *S. solarii*, n. sp.: Genital fork of 1, *virgatum*; 2, *solarii*. Adminiculum of 3, *virgatum*, 4, *solarii*. Dististyle of 5, *virgatum*, 6, *solarii*. Cocoon of 7, *virgatum*, 8, *solarii*. Respiratory filaments of 9, *virgatum*, 10, *solarii*. Figs. 1–6 drawn to same scale.

lecting of T. H. G. Aitken and Bernard Brookman to whom I am indebted for material. Most of the Texas specimens were collected by me in April 1941.

Malloch placed *Simulium hippovorum* in a different group of species from *virgatum* because of the presence of hairs on the pleuron in addition to and anterior to the pleural tuft. It is true that the type of *hippovorum* does show distinct pale hairs at the top of the anterior anepisternum, while these are not present in the specimens of *virgatum* from Las Vegas Hot Springs. Material from Texas reared from apparently identical pupae shows these hairs present or absent and it is my opinion that this character has no real significance. Dyar and Shannon (1927) also mentioned the variability in this character. Malloch also stated that the claw of *hippovorum* is untoothed, but a distinct but small tooth is visible on all three pairs of legs. The type of *hippovorum* would go to *virgatum* in the key to females of Vargas and Díaz (1948). The genital fork of the female is exactly as figured by Hoffmann (1930) for *Simulium virgatum chiapense* and agrees with that of one of the females of the type series of *virgatum*, and with those of two specimens from Chiapas, Mexico.

The type of *rubicundulum* shows a few fine hairs on the anterior anepisternum on one side. The genital fork of the female is exactly as in *hippovorum* and the other examples cited in the preceding paragraph. It runs to *hinmani* in the key of Vargas and Díaz (1948), but in that species the handle of the genital fork has no knob at the base.

It is not certain what specimen was used by Dyar and Shannon (1927) in figuring the genital fork of *virgatum*, but it could have been from the type series. The figure is slightly inaccurate since it fails to show the abrupt knob at the base of the handle. The male genitalia are also poorly drawn, and it is impossible to determine from what specimen the drawings were made. The specimen listed from Clio, Calif., is not now in the *virgatum* collection, and so its identity can not be verified. That from Devils River, Tex., is the new species described in this paper.

The description and illustrations of *virgatum chiapense* show this to agree in every detail with the females of the type series of *virgatum*. It is not clear what Hoffmann took to be the type of *virgatum* when he compared *chiapense* with it, but he probably thought that Dyar and Shannon's figures were accurate.

There seems to be nothing to distinguish *Simulium mathesoni* from *virgatum*, the slightly more rounded shoulders of the adminiculum, as figured by Vargas, being found in some specimens of *virgatum*. A comparison of the species here treated as *virgatum* with males, females, pupae, and larvae of specimens from Córdoba, Mexico, determined as *mathesoni* by Vargas, and kindly sent to me for that purpose, show no differences of any consequence.

The female description and the distribution of the species as given by Stains and Knowlton (1943) agree with *virgatum*, but the male is the following species and will be discussed there.

Vargas, Martínez, and Díaz (1946) made two errors in discussing *Simulium virgatum*. The first was in stating that the name *virgatum* was proposed to replace the preoccupied name *Simulium cinereum* Bellardi. This was not the case, since it was described as a new species with no mention of *cinereum*. Secondly, they assumed that the figures by Stains and Knowlton of the male of *virgatum* were correct so they based their identification of *virgatum* on the wrong species and resurrected *rubicundulum* for the true *virgatum*. It is possible that *tephrodes* Speiser (1904), a substitute name for *cinereum* Bellardi, is the same as *virgatum* since Morelia, the type locality of *cinereum*, is not outside the range of *virgatum*, but until the type of *cinereum* can be dissected and studied there seems to be no possibility of fixing its identity. It is outside the known range of the new species here described, but not of several of the other species of the group.

The topotype females of *virgatum* run to *hinmani* in the key of Vargas and Díaz (1948), differing from that species in the same manner as did *rubicundulum* previously discussed.

Simulium (Dyarella) Solarii, n. sp.

Simulium virgatum Coquillett: Stains and Knowlton, Ann. Ent. Soc. Amer. **36**(2): 274, figs. 90, 91. 1943 (♂ only); Vargas, Martínez, and Díaz, Rev. Inst. Salub. y Enferm. Trop. **7**(3): 106, 111, 164, 180, figs. 161, 162. 1948 (♂, larva).

Male: Thoracic length 1.3 mm; wing length 3 mm. Antenna yellow-brown, the scape and pedicel paler; clypeus gray-pollinose with pale hair; proboscis yellow; palpus brown with

brown hair. Scutum dark reddish brown, with fine, pale yellow, appressed hairs, the humeri pale yellowish; a slender median and a pair of curved submedian dark lines on scutum; when viewed from in front a small, subrectangular pollinose spot on each side of the median line at anterior margin of scutum, and sublaterally a short curved pollinose line just outside of the curved dark line but extending posteriorly only a short distance; a velvety dark brown spot in front of wing base; scutellum slightly paler than scutum, with longer, nearly white hairs; postnotum dark brown with gray pollinosity; pleuron yellowish to dark brown with thin grayish pollen; no anepisternal hair tuft, the mesepimeral tuft pale yellow; stem of halter yellow-brown, knob white. Wing veins yellowish brown; hairs at base of costa mostly pale yellow, a few dorsally darker; hairs of basal vein brown; no hairs on vein R; fore coxa yellow, mid and hind brown; femora yellow, narrowly, obliquely darkened apically; fore tibia yellow-brown sometimes somewhat variegated with yellow, with pale pile; mid and hind tibiae yellow-brown, with basal and subbasal paler rings; fore tarsus dark; mid tarsus with basal three-fifths of first segment white, the rest dark; hind tarsus with basal halves of first and second segments white, the rest dark. First abdominal tergite yellow, the rest brown; sublateral spots of whitish pollen on some of the segments; sternites pale yellow. Genitalia dark brown, the dististyle large, broad, with both margins curved (Fig. 6); adminiculum with a short median projection and acutely pointed lateral angles (Fig. 4).

Female: Thoracic length 1.5 mm; wing 3.5 mm. Antenna yellow-brown, the scape and pedicel yellow; frons grayish-pollinose; clypeus yellowish brown with thin gray pollen and pale hair; palpus brown with brown hair. Scutum when viewed from in front pale reddish brown, with a very slender median dark line and a pair of narrow curved dark lines merging with a dark prescutellar area, and usually connected at their closest proximity near anterior third of scutum by a narrow dark, transverse line; viewed from behind the dark pattern becomes nearly white on a darker ground; humeri pale yellow; a dark brown, rather small, velvety patch in front of wing base; pleuron yellowish to brown with whitish pollinosity; no anepisternal hairs; mesepimeral tuft yellowish; halter yellow, the stem darkened. Wing veins yellowish brown; hairs at base of costa mostly pale yellow, some dorsally darkened; hairs of stem vein dark. Leg color essentially as in male, but foretibia more frequently somewhat variegated. Abdomen dark brown, with grayish posterolateral bands on most segments; last three tergites subshining, brown; paraprocts with coarse hairs over most of surface; genital fork as figured (Fig. 2); the end of the handle may be somewhat swollen, but usually not as abruptly or strongly so as in *virgatum*.

Pupa: Respiratory filaments (Fig. 10) 15, (14 paired and 1 single) about 1 mm long, held in a tight, forward-curving clump. Dorsum of thorax smooth with no spicules or rugosities. Cocoon (Fig. 8) with a smooth anterior rim and no narrow projections. Total length 4 mm; dorsal length 3 mm.

Larva: This is not described in full at this time because my knowledge of simuliid larvae is not sufficient to evaluate the significant characters. The submentum of this species, lacking strong, sublateral teeth has been figured by Vargas, Martínez, and Díaz (1946, figs. 161 and 162) under the name of *virgatum* and that of *virgatum*, with strong sublateral teeth (fig. 160) under the name of *rubicundulum*.

Holotype: Male, San Saba River, Menard County, Tex. April 23, 1941 (A. Stone no. 68).

Paratypes: *Texas:* Same as holotype, 2 ♂ ♂, 1 ♀; Los Morros Creek, Menard, May 22, 1939, 9 ♀ ♀ (Roy Melvin), April 12–14, 1943, 1 ♂, 2 ♀ ♀ (C. L. Smith), August 10, 1942, 2 ♂ ♂ (Roy Melvin); Menard, June 21, 1939, 2 ♂ ♂, 10 ♀ ♀ (Roy Melvin); Upper Little Walnut Creek, Austin, 1936, 1 ♂, 4 ♀ ♀ (A. B. Griffen); Nueces River, Uvalde County, April 21, 1941, 1 ♂, 3 ♀ ♀ (A. Stone no. 57); Frio River at Con Can, Uvalde County, April 21, 1941, 2 ♂ ♂, 11 ♀ ♀ (A. Stone no. 59–60); ex breast of horse, Con Can, July 29, 1914,; 25 ♀ ♀ (D. C. Parman & F. C. Bishopp); Uvalde, June 7, 1938, 8 ♂ ♂ (W. L. Barrett, Jr.), April 13, 1939, 2 ♂ ♂, 2 ♀ ♀ (Deonier & Barrett); at light, Devils River, Valverde County, May 5, 1907, 1 ♀ (Bishopp & Pratt); Junction, Kimble County, February 21, 1938, 1 ♂, 1 ♀ (F. C. Bishopp); Kerrville, Kerr County, April 6, 1948 (C. W. Sabrosky) 1 ♀; Shovel Mount, Burnet County, April 12, 3 ♀ ♀. *Mexico:* Xicotencatl, Tamaulipas, May 1944,

1 ♂, 1 ♀ (M. Macias G.); Las Cascadas, San Luis Potosí, December 22, 1943 (A. Díaz N.); wings, legs, and genitalia of male and female on slides. Holotype and paratypes, U.S.N.M. no. 58956; paratypes, Instituto Saiubridade y Enfermedades Tropicales, Mexico.

Also in the Museum but not designated as paratypes are numerous larvae and pupae from Uvalde, Edwards, and Menard Counties, and the male genitalia from Austin mentioned below.

The name is derived from *solarium*, a balcony or terrace in the sun. This species appears to be most abundant in the Balcones Escarpment of Texas.

The figures of the male genitalia of *virgatum* published by Stains and Knowlton (1943) were apparently based upon a specimen of *solarii* from Austin, Tex. The slide from which I believe the drawings were made is labeled "Simulium virgatum Coq. Det. G. S. Stains 194, Austin, Tex. 10.18.22. Painter No. 60." Vargas, Martínez, and Díaz accepted these figures as correct and determined *solarii* in Mexico as *virgatum*.

The male of this species can be most readily distinguished from *virgatum* by the pale hairs at base of costa, the scutal pattern, the shape of the dististyle, and the acute lateral angles of the adminiculum. The female may be distinguished by the narrower curved stripes of the scutum, the usual connection between these near front of scutum, the usually paler hair at base of costa, the more extensively distributed hairs on the paraproct, and the shape of the genital fork.

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ZOOLOGY.—*Pharodinae, a new subfamily of Chondracanthidae (Crustacea: Copepoda), and a description of* Pharodes biakensis, *n. sp., from New Guinea.*[1]

PAUL L. ILLG, U. S. National Museum. (Communicated by WALDO L. SCHMITT.)

The genus *Pharodes*, instituted by C. B. Wilson in 1935, was assigned to the family Chondracanthidae. The species proposed then, *P. tortugensis*, alludes to the vicinity of the Tortugas Laboratory, the locality of the original collection of six female specimens. These came from three common species of host fish. The series is preserved in the U. S. National Museum and has been used in the present study to provide amplification of generic and specific characteristics. This report adds to the genus *Pharodes biakensis*, based upon a single pair. These were found as parasites of a small reef fish, *Caracanthus unipinnus* (Gray), collected at Biak, New Guinea, by F. M. Bayer. Parasites and host have been deposited in the National Museum. The identification of the host was provided by Dr. L. P. Schultz, curator, division of fishes. Dr. Schultz also made available a series of examples of the host from various Pacific locations, but examination of these failed to yield further specimens of the parasite. The Biak specimens furnish the first description of the male for the genus.

The assignment of the genus to the Chondracanthidae is accepted, but the characters of *Pharodes* are so strongly distinctive and several represent sufficient departure from the anatomical details of hitherto described chondracanthids that it is considered appropriate to set forth its basic features as diagnostic of a new subfamily. The definition of the family Chondracanthidae then requires emendation to include these characters.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received August 5, 1948.

Family CHONDRACANTHIDAE Milne Edwards

Cyclopoida; in the female presenting suppression of segmentation and great expansion of the body into a fleshy mass with various protrusions. Body regions a cephalothorax, trunk and abdomen. Antennules inflated or prolonged, not prehensile. Antennae terminating in prehensile uncirate claws or tripartite anchoring structures. Upper lip a flat plate or produced medially as a proboscis-like tube. No lower lip. Mandibles reduced, falciform, usually two-segmented, margins with or without serrations, in some cases bearing rows of spinules. Maxillules reduced, palplike, or absent. First pereiopods prominent maxillipeds, borne on the cephalothorax. Swimming pereiopods variously reduced. Abdomen with caudal rami, of one or more segments; these may be unarmed or ornamented with one to several inconspicuous setae. Marked sexual dimorphism. Male body conforming more to the cyclopoid facies, but dwarfed and with great reduction of segmentation and appendages. Maxillae and maxillipeds of more prehensile nature than those of female. Abdomen small, segmentation suppressed.

This definition is mainly based on that of Oakley, 1930. A very slight departure from the earlier diagnosis is the acceptance here of the recently widely prevailing view of the second oral appendage as the vestigial maxillule, rather than as a mandibular palp. The information contained in the present study has no bearing on the partition by Leigh-Sharpe and Oakley of the chondracanthids known in 1928 as two subfamilies, the Chondracanthinae and the Lernentominae. These groups are here accepted as completing the family subdivision.

PHARODINAE, n. subfamily

In the female, great expansion and inflation of the thoracic portion of the body, the abdomen reduced to a vestige placed relatively near to the midpoint of the thoracic mass. Oviducal openings ventral on the thorax at the level of the abdomen. Upper lip produced at its center into a prolonged, distinctly proboscislike tube, prolonging ventrally the food opening. Mandibles reduced, no marginal ornamentation. Maxillules absent. In the male, great inflation of the cephalothorax. Antennules and antennae placed well ventrally. A single pair of pereiopods, the maxillipeds.

One genus included, the type of the subfamily, *Pharodes* C. B. Wilson, 1935.

Genus **Pharodes** Wilson

Generic characters.—Female, head fused with segment of the maxilliped to form a cephalothorax. Dorsal carapace present. Main mass of body a trunk formed of thoracic segments coalesced and produced laterally and posteriorly as lobes and extensions. Abdomen borne ventrally as a vestige at about the midpoint of the trunk. Two pairs of pereiopods on the trunk, consisting of inflated, sac-like lobes. Male a dwarf, although not necessarily attached to the body of the female. Two main body regions, a roughly hemispherical cephalothorax and a narrow, short, curled, tail-like trunk. Antennule as in the female. Maxillae and maxillipeds of markedly prehensile nature.

Genotype.—*Pharodes tortugensis* Wilson, 1935.

Pharodes tortugensis Wilson

Only the female of this species has so far been collected. A partial revision of the characters as originally described as well as the addition of a number of details have been provided by the present study.

The usual chondracanthid character of great fleshy expansion and inflation of the body, accompanied by suppression and simplification of the appendages, is borne out in this form. Visible segmentation delimits two body regions—a head, actually a cephalothorax, since it bears maxillipeds, and a trunk, consisting of expanded thoracic somites. There is a sharply constricted neck. The characteristic appearance of the head is due to its expansion laterally, producing the aspect described originally as that of an inverted triangle. The middorsal surface of the head is set off as a highly chitinized carapace, apparently serving in part as a site of attachment for the considerably developed oral appendages.

The head is apparently freely moveable on the neck articulation. A position noted in several specimens was one of dorsal flexion, in the extreme producing nearly a right angle between the plane of the oral surface and the main axis of the body. In this position, the antennules and antennae protrude prominently, as seen in dorsal view. When the axis of the head is

aligned with that of the trunk, none of the appendages is visible dorsally.

The trunk, which actually is the free thorax, in dorsal view could be interpreted as a series of three globose enlargements, separated by constrictions and expanded laterally into variously developed lobes. Each of these three divisions, further, bears dorsally a rounded knob. The lateral processes of the first division are extremely extensive and flare out widely to the sides and then posteriorly, each nearly equalling in bulk the main mass of the thorax proper. The much less produced lateral processes of the second division are slightly curved, posteriorly directed, lappets. The lateral processes of the third division are just like those of the second, but exceed the latter somewhat in length. A posterior lappet, protruding directly posteriorly, also arises from the third division. This terminal division, with its pair of lateral lobes and single median projection, was interpreted originally as the abdomen. This view will be seen to be contradicted by further details of the present study.

All the contours of the dorsal surface are rounded and fleshy, as is characteristic among chondracanthids. In the original description, and cited as a generic character, it is stated that the posterior portion of the body is covered by two tripartite plates. The accompanying figure supported the description as given. However, comparison of the figure with the type specimen readily resolves the depicted appearance as the oversimplified linear rendition of the dorsally knobbed globular divisions with their lateral lobes and the posterior process. In agreement with other members of the Chondracanthidae, this genus possesses no rigid cuticular structures which might be interpreted as plates.

Ventrally, the subdivision of the free thorax or trunk is complicated by the inflated pereiopods and their basal structure. The expanded bases of the largest lateral lobes meet medially forming a ridge, the posterior edge of which roughly bisects the longitudinal axis of the trunk. Just anterior to this margin are the two flattened knobs which form the ornamentation of the oviducal openings, and between these is the slight eminence which is the vestigial abdomen. The posterior ventral portion of the trunk does not show distinct demarcation into globose segments as seen in dorsal view.

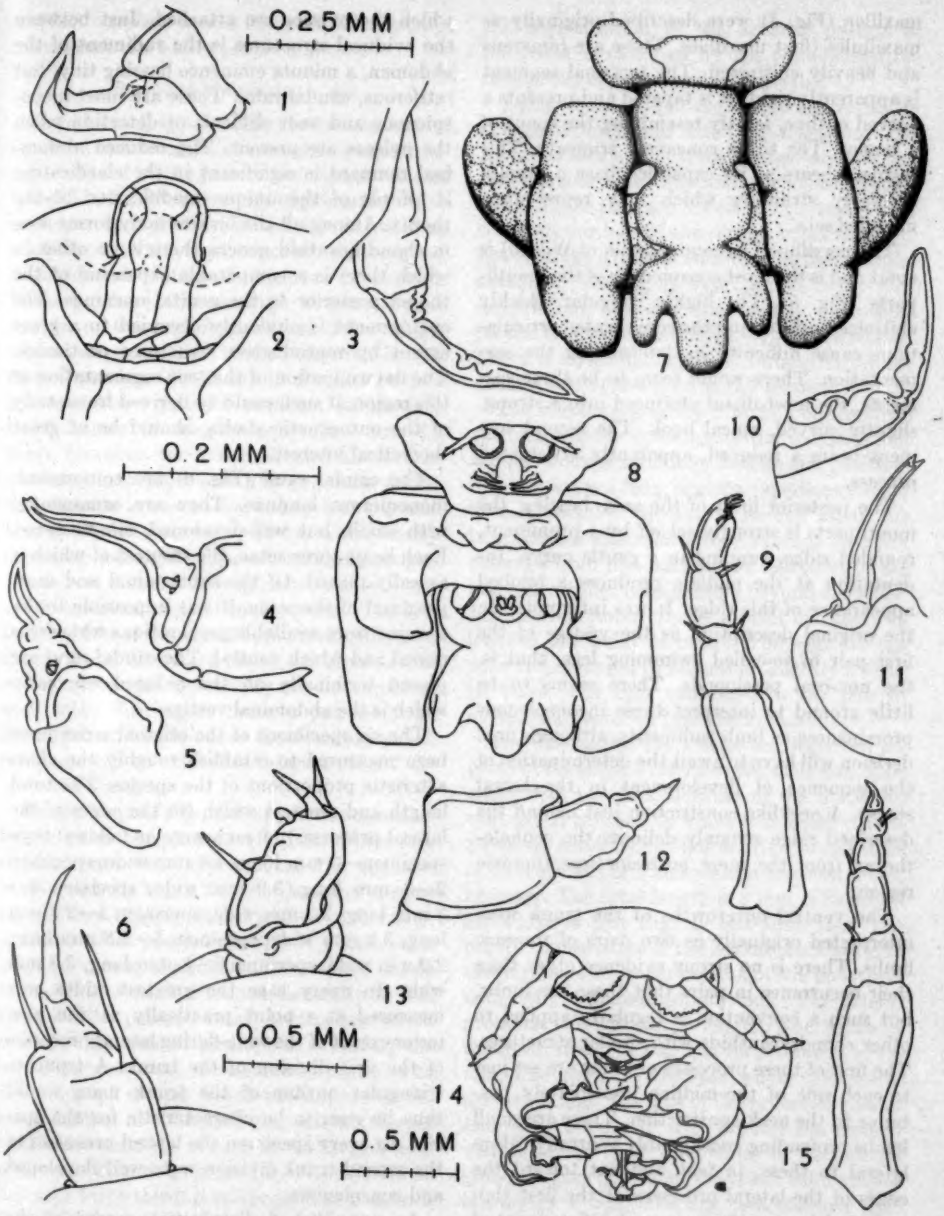
The antennules are very much unlike the usual inflated sacs characteristic of the family, bearing, rather, a greater resemblance to those found among the ergasilid parasites of fishes or among some of the chondracanthid males. They are strongly chitinized. The complicated articulations make it difficult to establish the segmentation accurately, but apparently there are four segments. The most distal segments are inconspicuously ornamented with a number of rather reduced setae.

The antennae (Fig. 1) are 2-segmented and strongly prehensile. The distal portion is a heavily chitinized, stout hook. As was pointed out in the original description, there is an inconspicuous outgrowth on the basal segment, representing perhaps a modified seta.

The upper lip is a most distinctive structure in the genus. It differs strikingly from the flattened crescentic plate of all the other members of the Chondracanthidae. Here there is a prolonged proboscislike structure, supported by a complicated chitinous framework and apparently capable of a limited amount of manipulation, as indicated by the presence of two slender muscle strands. The lateral margins are rolled and folded inward as thin chitinous flaps, forming a considerably prolonged mouth tube (Fig. 2). There is no comparable elaboration of an under lip. Posterior to the oral opening there is only an abrupt edge formed by the inturning of the integument of ventral surface of body.

The mandibles (Fig. 3) are so located that their bases are just lateral to the mouth. They are minute and inconspicuous, but distinctly of cyclopoid type. They differ from those of all other chondracanthids in the absence of marginal serration or spinulation. The surface of the mandible is very much thickened, but the constant appearance, in all preparations seen, of a much crumpled and wrinkled aspect would seem to indicate great flexibility rather than rigidity of the integument. The exact subdivision of the appendage, due to this wrinkling, is impossible to determine, but the appearance most consistently seems to indicate a 2-segmented condition, corresponding to the usual arrangement in nearly related copepods.

Examination of the limited material produced no evidence of the presence of maxillules. More refined dissections, when a larger number of specimens is available, may disclose the rudiments of these appendages among the complicated structures formed by the bases and chitinous supports of the mouthparts. The



FIGS. 1–6.—*Pharodes tortugensis* Wilson, female: 1, antenna; 2, oral area, showing upper lip and mandibles; 3, mandible; 4, maxilla; 5, maxilliped; 6, caudal ramus.

FIGS. 7–15.—*P. biakensis*, n. sp., holotypic female: 7, dorsal view; 8, semidiagrammatic drawing of ventral view; 9, antennule; 10, mandible; 11, maxilla; 12, maxilliped; 13, caudal ramus; allotypic male: 14, ventral view; 15, antennule.

The 0.25-mm scale refers to Figs. 1 and 15; the 0.2-mm scale to Figs. 2, 4, 5, 9, 11, 12; the 0.05-mm scale to Figs. 3, 6, 10, 13; the 0.5-mm scale to Fig. 14.

maxillae (Fig. 4) were described originally as maxillules (first maxillae). These are bimerous and heavily chitinized. The terminal segment is apparently rigid. It is tapered and presents a curved outline, faintly resembling the spout of a teapot. The tip is concavely truncate. This segment bears at its expanded base a minute accessory structure which may represent a modified seta.

The maxilliped (second maxilla of Wilson) is stout and is the most conspicuous of the mouthparts (Fig. 5). The highly irregular, thickly chitinized surface and the complicated articulations cause difficulty in determining the segmentation. There would seem to be three segments, the most distal produced into a strong, slightly curved, apical hook. The second segment bears a reduced, apparently articulated process.

The posterior limit of the area bearing the mouthparts is strongly set off by a prominent, rounded ridge, running in a gentle curve. Indentation at the midline produces a bilobed appearance of this ridge. It was interpreted in the original description as the vestige of the first pair of so-called swimming legs, that is, the non-oral pereiopods. There seems to be little ground to interpret these inconspicuous prominences as limb rudiments, although final decision will have to await the determination of the sequence of development in the larval stages. A necklike constriction just behind the described ridge strongly delimits the cephalothorax from the more posterior free thoracic region.

The ventral outgrowths of the trunk were interpreted originally as two pairs of thoracic limbs. There is no strong evidence other than their occurrence in pairs that these are limbs, but such a convention is regularly applied to other chondracanthids with similar structures. The first of these processes or limbs are set just to each side of the midline immediately posterior to the neck constriction. These are small knobs protruding considerably ventrally. More lateral to these, in fact well out toward the edges of the lateral processes of the first thoracic division, are the very much inflated second pair of trunk limbs. These are long and thick and directed slightly posteriorly.

Posterior to the pereiopods and slightly to each side of the midline are the oviducal openings. These are set off conspicuously by much enlarged perforated, disklike structures, to which the ovisacs are attached. Just between the oviducal structures is the rudiment of the abdomen, a minute eminence bearing tiny, but setiferous, caudal rami. These are most inconspicuous and very difficult of detection when the ovisacs are present. The reduced abdominal remnant is significant in the clarification it affords of the unique modification of the thorax. Among all the bizarre body forms seen in chondracanthid genera there is no other in which there is a comparable expansion of the thorax posterior to the genital openings. The enlargement is obviously occupied to a great extent by reproductive structures or tissues. The determination of the true segmentation of this region, if such could be derived from study of the ontogenetic stadia, should be of great theoretical interest.

The caudal rami (Fig. 6) are compressed, monomerous laminae. They are ornamented with small, but well-developed, simple setae. Each bears three setae, the stoutest of which is apically placed. Of the subterminal and most proximal of the setae, it was impossible to determine from available preparations which was dorsal and which ventral. The caudal rami are placed terminally on the reduced convexity which is the abdominal vestige.

The six specimens of the original series have been measured to establish roughly the characteristic proportions of the species. The total length and greatest width (to the edges of the lateral processes) of each were as follows: type specimen—3 mm long, 4.4 mm wide; specimen 2—3 mm long, 3.9 mm wide; specimen 3—3 mm long, 3.3 mm wide; specimen 4—2.8 mm long, 3.3 mm wide; specimen 5—2.8 mm long, 2.9 mm wide; specimen 6—3 mm long, 3.8 mm wide. In every case the greatest width was measured at a point practically at the posterior extent of the wide-flaring lateral processes of the first division of the trunk. A truncate triangular outline of the trunk mass would thus be seen to be characteristic for the species. In every specimen the lateral processes of the second trunk division were well developed and conspicuous.

An unpublished distribution record of the species is provided from the National collection. A single female was collected from the gills of *Scoliodon terrae-novae*, from the Gulf of Mexico, by C. B. Wilson, exact date and locality not known. A new host record is established also. As the specimen at some time had been sub-

jected to drying, it was not feasible to attempt to measure the bodily proportions.

Pharodes biakensis, n. sp.

Female (holotype).—The body consists of the head and trunk, a characteristic aspect being produced by the presence of expansions and lobes. The head bears a pair of processes which protrude considerably anteriorly as well as laterally, with the appearance of ear-like lobes. A middorsal chitinized carapace is present. Ventrally there is an elevation of the posterior margin of the cephalothorax as a low ridge, with a suggestion of bilobed division in the central portion. The trunk in dorsal view is a series of three globular sections, all in their main masses of roughly equivalent size. Of these, however, the first and third are further produced into processes. The processes of the first division are extended widely laterally and then produced posteriorly to an extent nearly equalling the length of the central trunk proper. Three low dorsal knobs appear serially along the longitudinal axis of each process. The second division of the trunk appears dorsally as a simple globe. The third division is globose, but is also produced posteriorly as an unpaired wide lobe. Further, it bears a pair of blunt lateral lobes, which curve considerably posteriorly as well as extending laterally. Fig. 7 depicts these details.

On the ventral side, the apparent segmentation is more complicated (Fig. 8). There is a distinct limit ventrally between the cephalothorax and the trunk but this juncture is compressed to a tightly closed groove in the type specimen. Just posterior to this is a transverse ridge, in extent of about half the width of one of the central trunk divisions. Laterally on this ridge are the paired ventral protrusions which represent the second pereiopods (counting the maxillipeds as first). Immediately posterior to this ridge is a second which extends across the main portion of the trunk and extends almost to the outer margin of each of the large lateral processes. This ridge is produced at its sides as the two large third pereiopods. These take a broad basal origin and protrude posteriorly and ventrally as long, thick, blunt lobes. In the ovigerous female these processes partially enfold the egg sacs. The medial portion of the second ridge cuts across the trunk at a level which would be about midway on the length of the second central division. However, the ventral segmentation of the anterior portion of the trunk is obscured by the complicated arrangement of ridges and outgrowths.

Lying at an oblique angle, directed ventrally and posteriorly, and fitted tightly against the posterior face of the second ridge, are the two prominences which surround the oviducal apertures. These thus are set on the ventral side of the posterior half of the second trunk division. Between the oviducal structures is the vestigial abdomen, bearing minute caudal rami. The constriction between the second and third central trunk divisions is fully visible ventrally. There is no complication of structures on the ventral side of the third trunk section.

The ovisacs are firmly attached on the discs surrounding the openings of the oviducts and are most characteristic in outline and position. The egg sac is a long, slightly tapering cylinder with a rounded tip and is curved along the longitudinal axis. Each thus extends laterally outward from just back of the midpoint of the body, protrudes considerably beyond the sides, and extends anteriorly to a level markedly in front of the point of origin. The eggs are minute and arranged in numerous, slightly irregular rows. The eggs contained in the pair of ovisacs number well into the thousands.

The dimensions (as well as the described aspect) of the single available specimen cannot be given with precision because of the markedly contracted position in which it is fixed. An attempt at establishing the relative proportions of the various parts and regions has been made, however. The total length is 3 mm. The greatest width is just slightly less than this. The parallel outer edges of the lateral processes give the outline of the main portion of the body pronouncedly squarish proportions. The lateral processes are 2.2 mm in length. The width of the head, from the edges of its processes, is 1.8 mm. The length of the head, along the central axis is .45 mm. The tips of the processes extend anteriorly about .15 mm beyond the central margin of the head. The width of the central globular mass of each of the trunk subdivisions is roughly 1 mm. The egg sacs measure 2.55 mm along the main axis and have a maximum diameter of about .75 mm.

The antennules (Fig. 9) are 4-segmented. The basal segment is longer than the terminal three together. It is three times as long as its greatest width, which is seen at two thirds of the length of the segment from its base. The

second segment is slightly longer than the third and about equal in length to the fourth. The segments decrease in their greatest widths in linear order. The antennule is not conspicuously inflated or saclike. A fairly heavy degree of chitinization is apparent and the articulations between segments are very complicated, indicating possibly some restriction as to planes of freedom of motion. There is a slight degree of compression of the appendage in the frontal plane of the body. The ornamentation consists only of reduced, inconspicuous setae. The basal segment seemingly lacks setae; the second and third each bear a lateral and medial seta at the distal corners. The terminal segment has a distal row of four, perhaps more, setae. The length of the antennule is 435 micra.

The single female specimen (as well as the accompanying male) had lost the antennae. Evidently these were sufficiently effective prehensile organs that they were completely torn away in the removal of the parasites from the host. Large, circular, articulating bases remain to indicate the proportion of the basal segment. It seems reasonable to assume that these appendages differ slightly, if any, from those of *Pharodes tortugensis*.

The upper lip is prolonged in the midline as a proboscis-like organ, with a folded-over, circular tip. In the intact specimen, the structure was held at approximately right angles to the body axis. The mouth opening lies just posterior to the upper lip with the bases of the mandibles set well to each side. The condition of the integument of the mandibles makes determination of the number of segments dubious but there are probably two. The base is rather stout and short, slightly longer than wide. The terminal portion is narrower and longer than the base, and consists of a slightly tapering cylinder with a bluntly rounded tip (Fig. 10). There is no serration of the margins, nor any detectable ornamentation. The length of each mandible is approximately 125 micra. No maxillules could be found.

The bimerous maxillae (Fig. 11) are much larger than the mandibles. The proximal segment is wide and short, its articulation with the main body mass forming a steep slant across its breadth. The length of the segment along its center axis is about 100 micra. The integument is heavily sclerotized. Internally are numerous bands of muscle attached to the base of the terminal segment, which forms an angle of attachment of about 90 degrees. The distal segment is expanded basally, then constricted sharply to a prolonged, slightly tapered, rigid terminal process, 200 micra in length over all. The tip is truncate and sharply indented. A short, stout seta is borne on the base of this segment.

The maxillipeds (Fig. 12) are characterized by great thickening of the integument. This causes difficulty in establishing the segmentation accurately. There is a large, clearly delimited basal segment, 150 micra long, with a width of 45 micra. This roughly rectangular, slightly curved, segment has a distinctly subterminal articulation with the remaining portion of the appendage, which is of the same total length. The most probable interpretation of this distal section would be as a single segment, 110 micra in length, bearing distally a distinctly articulated, blunt spine 40 micra long. At a level about 75 micra from its base this section exhibits transverse furrows of the integument and interruptions of the internal bands of muscle which would seem strong evidence of coalescence of an originally bimerous structure. The greatest width of the terminal section is slightly greater than half that of the proximal segment. The distal half of the terminal section is tapered sharply to the base of the articulated spine.

The trunk pereiopods are fleshy lobes, with little semblance remaining of articulated appendages. Those of the anterior pair are placed close to the midline and are far anterior on the trunk. They are very short lobes protruding directly ventrally. The slightly more posterior third pereiopods (second pair of trunk appendages) are very long fleshy lobes, 1.1 mm in length, and each is placed well out on the anterior lateral process of the trunk.

The caudal rami (Fig. 13) are laminae, compressed in the sagittal plane of the body. The ornamentation of each consists of two terminal setae, placed close together; a rounded process, which is possibly a modified seta, placed somewhat subterminally; and a long slender seta placed slightly beyond the midpoint of the ramus. Whether this most proximal seta is dorsal or ventral on the ramus could not be made out from the available preparation. Each caudal ramus is 55 micra long, with the greatest dorsoventral measurement slightly over 40 micra. The rami are borne very close together on a low convexity, placed between

the eminences bearing the oviducal apertures. This convexity, with its appendages, constitutes the vestige of the abdomen. At a point one fourth of its length from its base each ramus is conspicuously marked on the surface by elaborate chitinous convolutions. These do not seem to constitute a complete subdivision of the ramus into a bimerous condition. The exact significance of this complicated integumentary pattern remains doubtful.

Male (allotype).—The cephalothorax is greatly arched and rounded dorsally, and its general outline is ellipsoidal. The narrow trunk, consisting of an indeterminable number of thoracic and abdominal segments forms a curled tail-like process, of only a quarter of the width of the cephalothorax. The greatest width of the cephalothorax is 1.4 mm. The length along the central axis is 1.1 mm. The trunk is nearly parallel-sided, 0.41 mm in length and about 0.3 mm in width, with a short wide flaring at the point of juncture with the cephalothorax.

All the appendages of the cephalothorax are placed well on the ventral side (Fig. 14). The antennules (Fig. 15) are markedly subapical and their bases are widely spaced laterally. Each is 650 micra long. The number of segments is here interpreted to be four, although complicated grooving of the integument distally makes it impossible to determine the articulations exactly. The basal segment is distinctly set off. It is slightly longer than the rest of the segments together. It is 350 micra in length and the width at the most expanded point is just one third of this measurement. The second segment is 100 micra long and 85 micra wide at the widest point. The third segment is markedly narrower than the preceding, measuring 55 micra in width and 80 micra in length. The remainder of the appendage is 135 micra long and measures 45 micra at the greatest width, at the base. This sector tapers gradually and terminates, by a sharp constriction, in a slender spine. The exact metamerism is obscure, but this portion seems to represent a coalescence of three segments or perhaps of two segments and an articulated spine with a greatly expanded base. Complete details of the ornamentation were not made out. The second and third segments each bear a distal seta. The distal segment, in addition to its apical spine, bears two reduced subterminal setae.

The antennae of the single specimen were lost in removal from the host. Of considerable significance here is the fact that this male was not attached to the body of the female as is the usual case among the chondracanthids. The basal scars left by the tearing away of the antennae were comparable to the same artefacts in the case of the female.

The upper lip is produced considerably ventrally, but does not take the tubular proboscislike form like that seen in the female. The mandibles, as in the female, are inconspicuously placed anterior to the bases of the larger and more prominent remaining oral appendages, and are set to each side of the rather large mouth opening. The mandibles measure about 120 micra in length. They are slender, tapering falciform appendages, with no ornamentation. No trace of maxillules detected.

The maxillae present the appearance of exceedingly powerful prehensile organs. The basal portion is a stout segment, about 300 micra in length and of slightly greater width. Set at nearly right angles on the distal surface of this segment and directed medially is a very massive claw, 400 micra long. This claw tapers from a base about 275 micra in width to a keenly pointed, stoutly spinous apex. The whole appendage is heavily sclerotized, and the terminal claw appears to be nearly completely solid.

The maxillipeds are tripartite. The basal segment is about 450 micra long and has a maximum width of about 300 micra. The outline of the segment is roughly rectangular. The second segment is so articulated on the first as to be directed considerably medially and ventrally. It is about 200 micra long and its width is about 175 micra. On its distal surface is set a strong, tapered claw. The base of the claw is about 125 micra in extent. Its length is 250 micra and it curves in a smooth taper to a stout point. This appendage, like the preceding, is heavily sclerotized. No other thoracic appendages could be made out.

The caudal rami are minute, roughly rectangular, about 90 micra long, and each bears apically a rather stout, short, tapered seta. The rami are borne on a broadly flattened area at the tip of the tail-like trunk. There is no evidence from the adult condition for determining the degree of inclusion of anatomically thoracic or abdominal segments in the trunk structure; except, of course, that the tip, in bearing the caudal rami, is marked as of abdominal origin.

Type locality.—Biak Island, Schouten Islands, Netherlands New Guinea.

Types.—Holotypic female, U.S.N.M. no. 86009, and allotypic male, U.S.N.M. no. 86010; from the gill cavity of *Caracanthus unipinnus* (Gray), collected April 3, 1945, by F. M. Bayer.

Remarks.—The two species of *Pharodes* unfortunately must be based upon an extremely small number of representatives. When more adequate series are available and the range of variability of the two forms is established, it may well be that some of the distinguishing features found here will be discarded as no longer significant. However, the consistent conformation to the structure of the chondracanthids in general, in various forms of which extensive information as to variability is available, is good grounds for the prediction that the differentiation of these forms will continue to be supportable.

Pharodes biakensis is easily separated from *P. tortugensis* by a number of features of body form. The more extreme production of the lateral processes of the head, the much more nearly quadrate aspect of the main mass of the body with its expansions, and the lack of a pair of lateral processes on the second division of the trunk provide a ready basis of recognition of the former.

The differentiation of the appendages in the two species is in the main a series of subtle variations on a basic plan of structure. In the female *Pharodes biakensis*, as compared to its congener, the mandible is shorter in proportion and somewhat more blunt apically. The maxilla bears a well-developed accessory seta, represented in *P. tortugensis* by a modified element of characteristic appearance. The maxilliped exhibits a greater suppression of segmentation and the terminal spine is somewhat slighter and simpler. The caudal rami have a different pattern of armature and an indication of subdivision.

The sexual dimorphism in *Pharodes biakensis* has a number of features of interest by comparison with the condition in other chondracanthids. The general rule is a by far greater absolute size disparity. The male is typically a minute dwarf and usually is to be found attached on or near the genital aperture of the female. In *Pharodes* the male is of large size and obviously is capable of independent existence on the host. Also worthy of note is the fact that the antennule, maxilla, and maxilliped of the male reach actually greater absolute dimensions than the counterparts in the female. The basically similar pattern of structure of the antennules in the two sexes is a contrast to the usual chondracanthid situation of an inflated sac-like appendage in females and a less modified male antennule. The scars remaining indicate that the antennae were of about equivalent size, at least at the base, in the two sexes. The mandibles show little disparity. The different degree of development of the tubular upper lip indicates the highly special character of the modification as seen in the female.

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ZOOLOGY.—*Two new species of polychaete worms of the family Polynoidae from Puget Sound and San Juan Archipelago.*[1] MARIAN H. PETTIBONE, University of Washington. (Communicated by WALDO L. SCHMITT.)

The two new species of Polynoidae herein described were obtained in connection with a study of the scaled Polychaeta in the San Juan and Puget Sound region. The work was carried out at the University of Washington Oceanographic Laboratories, Friday Harbor, Wash. Dredging was carried out from the M.S. *Catalyst* and M.S. *Medea*. The types are deposited in the United States National Museum.

Family Polynoidae

Genus **Harmothoë** Kinberg

Harmothoë hartmanae, n. sp.

Fig. 1, *a–f*

This species is represented by three speci-

[1] Received September 8, 1948.

mens from material dredged in the San Juan Archipelago. I take pleasure in naming it after Dr. Olga Hartman, who has done so much to add to our knowledge of the Polychaeta.

Description.—The type (U.S.N.M. no. 21101), the largest of the three specimens, has 37 segments. It is 23 mm long, 6.5 mm wide exclusive of setae, and 9.5 mm wide inclusive of setae. The smallest of the paratypes is 8.5 mm long and 2 mm wide exclusive of setae. The body is short, nearly linear, widest in segments 12–23, tapering slightly anteriorly and posteriorly. The body is without color in the middorsum, greenish on the cirrophores and the parapodia. The ventral surface is shiny iridescent and without color except for a dark coloration around the mouth.

Fifteen pairs of elytra nearly cover the dorsum and are slightly imbricated, arranged on segments 2, 4, 5, 7, 9 . . . 23, 26, 29, and 32. The elytra are subcircular to subreniform in shape, thin, and shiny, appearing smooth, but furnished with conical blunt microtubercles (Fig. 1, *c–d*). A dark border completely encircles the first pair of elytra and around the posterior, median, and lateral borders of the other elytra. Microscopically, this border appears as darker polygonal areas (Fig. 1, *d*).—not present on *Harmothoë imbricata* (Linnaeus)—the widespread cosmopolitan species. The elytral border is smooth except for a few short filiform and clavate papillae.

The bilobed prostomium is wider than long, has a wide anterior median sulcus and prominent cephalic peaks; the four eyes are large, the anterior pair situated anteroventrally and slightly posterior to the peaks (Fig. 1, *a*). The median antenna has a large brown ceratophore and a long slender style with a slight subterminal enlargement and very short scattered clavate papillae; the style is dark, especially above and below the enlargement. The lateral antennae have short brown ceratophores, inserted ventrally on the prostomium; the styles are brown, short, tapering gradually to filiform white tips and furnished with very small papillae. The palpi are long—up to five times the length of the prostomium, slender, and with short papillae.

The proboscis has the usual polynoid form, with nine pairs of distal papillae and two pairs of amber-colored interlocking jaws; it extends the length of the first 12 segments; the proximal half may be darkly colored. The segmental papillae begin on segment 6 and continue posteriorly; they are very small and bulbous in the more anterior and posterior segments but long and cylindrical in the segments of the middle third of the body.

The basal lobes of the tentacular segment are elongated, each bearing two setae; the tentacular cirri are similar to the median antenna (Fig. 1, *a*). The dorsal cirri have elongated cirrophores with a bulbous base and narrower distal part; the styles are long, slender, similar to the median antenna, and extend beyond the tips of the setae. The dorsal tubercles of the cirri-bearing segments are prominent conical lobes. The ventral cirri are thick proximally, tapering to filamentous tips (Fig. 1, *b*).

The parapodia are biramous. The notopodium is a rounded lobe on the anterodorsal face of the neuropodium, extending out into an acicular lobe from which the aciculum projects (Fig. 1, *b*). The notosetae are golden, moderate in number (about 40), forming a spreading bundle, thicker than the neurosetae (45–62μ in greatest diameter), slightly arched, with long spinous regions—about half the exposed length—and bare pointed tips (Fig. 1, *b, e*). The neuropodium tapers distally to a thick acicular lobe from which the aciculum projects (Fig. 1, *b*). The neurosetae are golden, moderate in number, and more slender than the notosetae (16–44μ in diameter in the stem region: 22–48μ in the enlarged distal part). The supraacicular group of neurosetae (about 12 in number) are the longest, with long spinous regions (20–24 rows), and a strong secondary tooth on all the setae; the subacicular group (about 26) range from longer dorsal to shorter ventral ones, with short spinous regions (12–14 rows), and with a strong secondary tooth except on the lower ventral ones (Fig. 1, *f*).

Remarks.—*Harmothoë hartmanae* resembles the cosmopolitan species, *H. imbricata* (Linnaeus). It differs chiefly in the character of the elytra as described above.

Locality.—The specimens were dredged west of Crane Island in the San Juan Archipelago in 20 fathoms on a shelly bottom.

Genus **Lepidasthenia** Malmgren

Lepidasthenia berkeleyae, n. sp.

Fig. 2, *a–f*

This species is represented by three specimens taken from three places in the south end of Puget Sound—in Carr and Case Inlets. I am

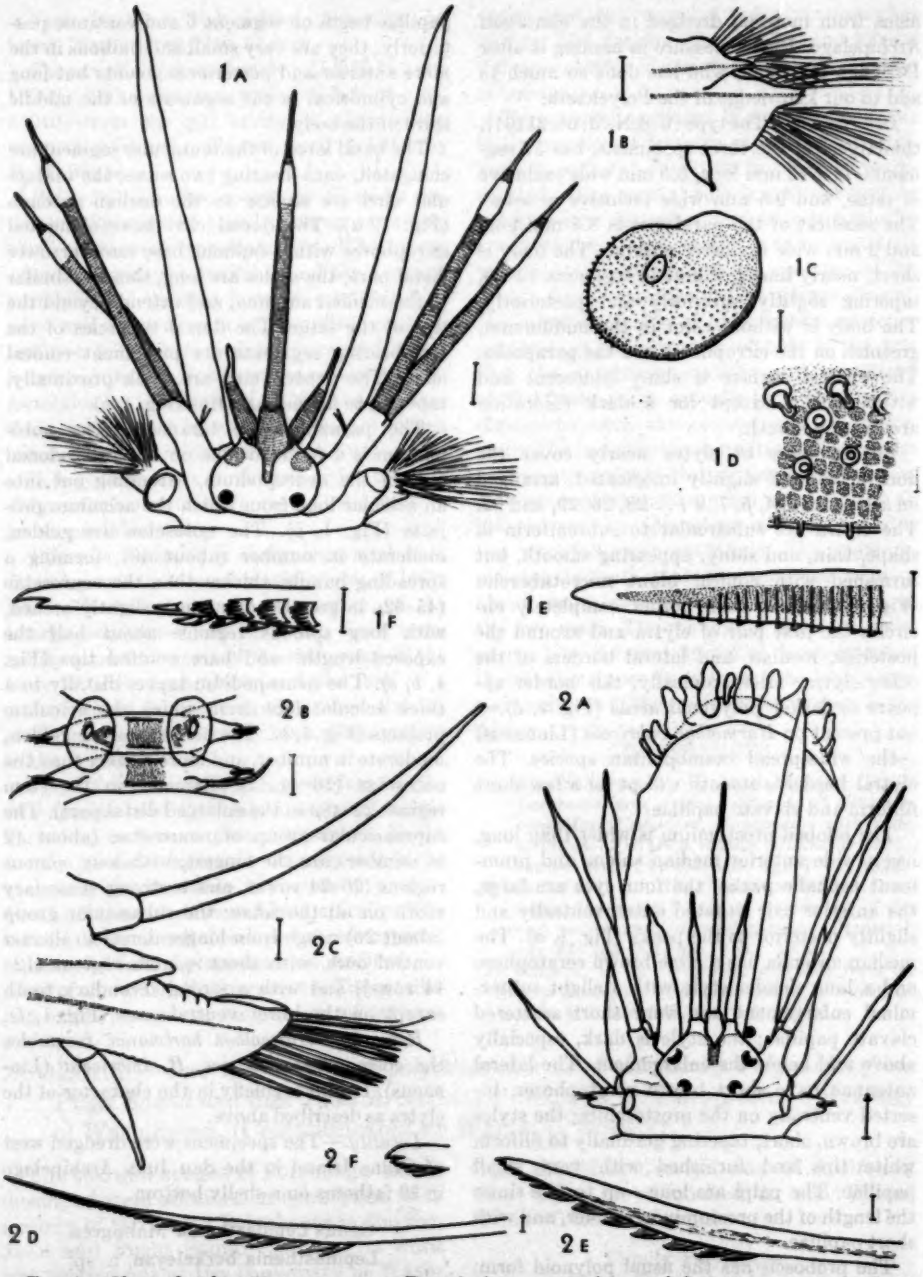

FIG. 1.—*Harmothoë hartmanae*, n. sp.: *a*, Dorsal view prostomium and first two segments, elytra removed; *b*, sixteenth left parapodium, anterior view; *c*, fourth left elytron; *d*, part of posterior border of elytron, enlarged; *e*, tip of notoseta; *f*, tip of middle subacicular neuroseta.

FIG. 2.—*Lepidasthenia berkeleyae*, n. sp.: *a*, Dorsal view prostomium, first two segments, and extended proboscis, with elytra removed; *b*, dorsal view two segments from anterior third of body; *c*, twenty-second left parapodium, anterior view; *d*, dorsal neuroseta; *e*, middle neuroseta; *f*, tip of same.

Scale measurements as follows: 1*a*, 1*b*, 2*c* = 0.43 mm; 2*a*, 2*b*, 1*c* = 0.95 mm; 1*d* = 30μ; 1*e* = 48μ; 1*f* = 38μ; 2*d* = 9μ; 2*e* = 15μ.

naming this species after Edith Berkeley. She and her husband, Cyril Berkeley, are workers on the Polychaeta and have established the commensal host of this species. *Lepidasthenia berkeleyae* resembles *L. longicirrata* Berkeley (Berkeley, 1923, 1942), a species that has been found in the Puget Sound region also. The differences are referred to in the text. E. and C. Berkeley consider *L. berkeleyae* to be the commensal form of *L. longicirrata* and not a distinct species (Canadian Pacific Fauna: Polychaeta Errantia. In press). They have found it commensal with the mud tube-dwelling polychaete, *Praxilella affinis* (Sars) var. *pacifica* Berkeley (family Maldanidae).

Description.—The type (U.S.N.M. no. 21099), of some 100 segments, is complete, although the posterior end of 23 segments was regenerating. The two paratypes are incomplete anterior ends (70 and 54 segments). The type, of 100 segments, is 75 mm long, 4 mm wide excluding setae, and 6 mm wide including setae. The body is flattened dorsoventrally, long, narrow, with sides nearly parallel, tapering slightly anteriorly and posteriorly. Each segment has a wide transverse middorsal brown band, the anterior and posterior part of which may be darker. The basal part of the parapodia, the cirrophores and elytrophores are darkly pigmented. The body is more darkly pigmented anteriorly than posteriorly. The ventral surface is without color. (The ventral surface lacks the globose papillae found on *L. longicirrata*.)

The 37 pairs of elytra of the type are arranged on segments 2, 4, 5, 7, 9 . . . 23, 26, 29, 32, 34, 37, 40 . . . every third segment to the end of the body. The elytra are small, oval, and do not nearly cover the dorsum but leave a median longitudinal zone uncovered—about equal to the width of an elytron (Fig. 2, *b*). (In *L. longicirrata*, the elytral pairs are larger and practically cover the dorsum.) The elytra are thin, transparent, blotched with brown pigment, especially around the place of attachment to the elytrophore and the area medial to it.

The bilobed prostomium is much wider than long, with a distinct anterior median sulcus (Fig. 2, *a*). The four eyes are large, the anterior pair being larger and located just anterior to the greatest width of the prostomium. The lateral antennae are inserted terminally on short anterior prolongations of the prostomium; the styles are slender, approximately equal in length to the greatest prostomial width, and have slight subterminal enlargements and filamentous tips. The median antenna has a short ceratophore; the style is slender, long—about twice the prostomial width—and with a fine filamentous tip. The palps of one paratype are missing; those of the type and the other paratype have one long slender palp—about three times the greatest prostomial width—and one shorter one (probably regenerating). Antennae and palps are without color or papillae.

The proboscis has the usual polynoid form, with nine pairs of distal papillae and two pairs of dark amber-colored interlocking jaws; it extends the length of approximately the first 12 segments. The paired segmental papillae begin on segment 6 and continue posteriorly; they are short and bulbous.

The large basal lobes of the tentacular segment are each furnished with an aciculum which projects in a short achaetous fingerlike process; the paired tentacular cirri are similar to the median antenna (Fig. 2, *a*). The anterior few pairs of dorsal cirri resemble the median antenna; the more posterior cirri are slender, transparent, evenly tapered, and extend slightly beyond the tips of the setae (Fig. 2, *c*). The paired ventral cirri of the second segment are long, slender, similar to the tentacular cirri (Fig. 2, *a*); those of the following segments are short and subulate (Fig. 2, *c*). The paired anal cirri are similar to the dorsal cirri.

The parapodia are moderately long and slender. The notopodium is a short, fingerlike, achaetous lobe, furnished only with an aciculum; the tip of the lobe does not nearly reach the dorsal cleft of the neuropodium (Fig. 2, *c*). (This is in contrast to *L. longicirrata* in which the notopodial lobe is more elongate and the tip extends to the dorsal cleft of the neuropodium.) The distal end of the neuropodium has a dorsal cleft; the lobe anterior to the cleft and the one which contains the aciculum is only slightly longer than the posterior lobe (Fig. 2, *b–c*). (In *L. longicirrata*, the anterior lobe is decidedly longer than the posterior lobe.) The neurosetae are of two kinds: (1) a dorsal group of setae (about four in number) are elongated, slender (10 μ in greatest diameter), with long spinous regions, tapering distally to fine tips (Fig. 2, *d*); (2) a median and ventral group of setae (18–25 in number) are shorter, stouter

(10–19μ in greatest diameter—the more ventral ones being shorter and thinner); they have short spinous regions (8–12 rows), with no bare distal tips; the distal tips are bifid—the secondary tooth blends in with the spinous rows or it may be inconspicuous (Fig. 2, *e–f*). (This is in contrast to *L. longicirrata* in which the middle neuropodial setae are distinctly bifid, with bare distal tips.)

Habitat.—The specimens were dredged from mud in 35 to 70 fathoms. E. and C. Berkeley (in correspondence) have found them commensal in the mud tubes of the polychaete *Praxilella affinis* (Sars) var. *pacifica* Berkeley. (This is in contrast to *L. longicirrata* which is usually found free in dredge material. However, on two occasions, I found them within parchmentlike tubes, agglutinated with bits of shell and rock—a tube evidently of their own making.) The extreme delicacy of the elytra and body would indicate a somewhat protected habitat for both species.

Locality.—Type: off Green Point, Carr Inlet, 51 fathoms in mud. Paratypes: near Gertrude Island, Carr Inlet, 70 fathoms in mud; off Herron Island, Case Inlet, 35 fathoms in mud.

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ZOOLOGY.—*American Caudata, V: Notes on certain Appalachian salamanders of the genus* Plethodon.[1] M. B. MITTLEMAN, New Rochelle, N. Y. (Communicated by HERBERT FRIEDMANN.)

The action of Pope and Hairston (1948: 106–107) in describing two nominally new races of salamanders, *Plethodon shermani rabunensis* and *P. s. melaventris*, reflects a taxonomic viewpoint radically opposed to that of Grobman (1944) and some other workers. As pointed out by their describers, *rabunensis* and *melaventris* have been "for many years . . . identified as *P. metcalfi:* more recently by Grobman as *P. clemsonae.*" Obviously, the status and proper allocation of Pope and Hairston's new forms are contingent upon the definitions of the species *clemsonae* and *metcalfi*.

Based on topotypic material, the structural characters of *clemsonae* may be summarized as follows: Costal grooves 15 or 16 (including inguinal and axillary branches of the first and last grooves); appressed toes sometimes meeting, but more often separated by one or two costal folds; vomerine teeth 9–12 per series. The color characteristics of *clemsonae*, which are so important in differentiating it from certain other related species of *Plethodon*, have been subject to considerable discussion. Brimley's original description (1927: 73–74) shows that some of his type specimens had white or grayish dorsal markings when fresh, while others were uniformly black on all dorsal surfaces. Two topotypes collected by Arnold Grobman and myself possessed whitish-gray (ashy) lichenoid markings in life, which were particularly prominent along the sides of the head and body (see Bishop, 1943: fig. 64). Grobman has discussed (1944: 294) the possibility that the absence or presence of light pigments in *clemsonae* may be associated with the length of preservation, as is occasionally the case in such species as *Plethodon richmondi*, *P. nettingi*, and *P. welleri*. This is, of course, a distinct possibility, but it is likewise true that some *clemsonae* are quite immaculate; pigmentation in *clemsonae* is evidently subject to some variation, as in other species of *Plethodon*. The color characteristics of *clemsonae* are a black dorsum and belly (belly varying from almost pure black to a very dark slaty gray), with the throat (and occasionally the anterior part of the breast) whitish or grayish, with a grayish white pattern of irregular lichenoid maculations sometimes present on the dorsum and sides of the head and body.

Brimley's type of *metcalfi* is an adult

[1] Received September 9, 1948.

male (snout-vent 60 mm), with 15 costal grooves, no costal folds between the appressed toes, 11 or 10 vomerine teeth, uniform bluish above and grayish tan or fawn below. Salamanders agreeing closely with this type are known from southwestern North Carolina (Haywood County) north through the southern Blue Ridge Province to Beartown Mountain (4,500–4,700 feet) near Burkes Garden, Tazewell County, Va. (Hoffman and Kleinpeter, 1948: 603), and Mount Rogers (5,000–5,600 feet); Grayson County, Va. (collected by Hoffman and Kleinpeter). On the other hand, specimens from more southerly and westerly points in the Carolinas and Georgia possess characteristics that identify them with *clemsonae*, as described above. As pointed out originally by Grobman (1944), these dark-bellied "*metcalfi*" are in fact conspecific with Brimley's *clemsonae*, and the two forms—the light-bellied *metcalfi* and the dark-bellied *clemsonae*—occupy predominantly vicarious ranges (1944: fig. 5). The distribution of *clemsonae* extends from Macon, Jackson, and Transylvania Counties, N. C., to Pickens and Greenville Counties, S. C., and Rabun and Habersham Counties, Ga.

Pope and Hairston (*loc. cit.*) have described certain specimens of the dark-bellied *clemsonae* from Rabun Bald Mountain, Rabun County, Ga., as *Plethodon shermani rabunensis*, diagnosing their new salamander as "a member of the *jordani-metcalfi* group with white spots on the cheeks and along the sides of the body. The legs are never red as in *B. s. shermani*." The description points out further that the type (adult female, 118 mm total length, snout-vent 62 mm) has 13 costal grooves and vomerines 10–7, and that "the color is black above, shading into dark gray below; the throat is paler than the belly." As given, the description of *rabunensis* offers no tenable point of difference to distinguish this nominal subspecies of *P. shermani* from *P. clemsonae*, except for the presence of 13 costal grooves (as compared to 15 or 16 in *clemsonae*). Yet even this apparent difference is illusory, and arises as a result of the method used in counting costal grooves, rather than indicating a true meristic difference. In order to obtain the full costal groove count in *clemsonae* the axillary and inguinal branches of the first and last grooves must be counted. Sometimes these are poorly developed or obscure as a result of preservation; if they are not included, a count of 13 or 14 is obtained, rather than 15 or 16. In practice, most herpetologists use the "maximum count" method, which includes the axillary and inguinal branches. Hence, with the apparent costal groove count difference negated, there appears to be no salient difference between *rabunensis* and *clemsonae*, and I conclude that these forms are identical.

The status of Pope and Hairston's new *P. shermani melaventris* likewise seems poorly established. In this instance the race is diagnosed as "An immaculate member of the *jordani-metcalfi* group with a black belly." The type is further described as being an adult male (total length 116 mm, snout-vent 60 mm), with 14 costal grooves, 10 or 11 vomerine teeth, body and limbs immaculate black above and below, throat gray; Pope and Hairston state also that their 112 paratypes from Macon, Jackson, and Transylvania Counties, N. C., exhibit no significant variation. The range of *melaventris* is given as extending from Swannanoa, Buncombe County, N. C., to Greenville County, S. C., and westward to Highlands, Macon County, N. C. As in the case of *rabunensis*, the description of *melaventris* offers no characters to set it apart from *clemsonae*, save for the costal groove count, and this again reflects a method of counting rather than a real difference.

The fundamental difference between *metcalfi* and *clemsonae* lies in the ventral pigmentation, as previously discussed. In addition, *metcalfi* is a slightly longer-toed form, occasionally having one costal groove between the appressed toes, but more often none, while in *clemsonae* there is usually at least one groove between the toes, and only rarely do the toes meet or overlap (in adult specimens). Of the two, *metcalfi* tends to have shorter vomerine series, the range of vomerine teeth counts in specimens I have seen being 6–12, average 8.1,

whereas in *clemsonae* the variation is 6–16, average 9.1. The examination of several series of salamanders from the vicinity of Highlands, Macon County, N. C., reveals considerable variation in the degree of intensity of the belly pigment. For example, in a series of specimens from Mirror Lake, near Highlands, U.S.N.M. no. 88010, female (snout-vent 58 mm), has an immaculately black back and belly, as do also U.S.N.M. no. 88014 male (snout-vent 56 mm), and no. 88016, female (snout-vent 58 mm). On the other hand, three smaller specimens taken at the same time and locality (U.S.N.M. nos. 88011–13, all males, snout-vent 40, 49, 46 mm) have black dorsums and light grayish throats, but dark yellowish gray bellies. Similarly, in U.S.N.M. nos. 104527–31, from Little Yellow Mountain, 4,100 feet, near Highlands, two large females and a male (snout-vent 50, 63, and 60 mm, respectively) have black backs and bellies, while two smaller females (snout-vent 39 and 44 mm) have gray bellies. Another specimen, U.S.N.M. no. 72825, female, Whiteside Mountain, near Highlands (snout-vent 67 mm), is black above and dark slaty gray below. Specimens I have seen from Rabun and Habersham Counties, Ga., and Pickens County, S. C., are uniformly black above and below (except for the throat), from immaturity (snout-vent 35 mm) to maximum adult size (snout-vent 80 mm), although they occasionally have grayish or grayish-white fleckings on the head and body. Taken in their entirety, the variations of *metcalfi* and *clemsonae*, as well as the vicarious ranges and apparent intergradation in Macon County, N. C., make it evident that these two forms are allopatric races of the same species and accordingly should be recognized as *Plethodon metcalfi metcalfi* and *P. m. clemsonae*. The consistent types of ventral pigmentation that characterize the two races within their respective ranges, and the apparent association in part between size (age) and degree of belly pigmentation in some Highlands specimens, may indicate not only intergradation in the vicinity of Highlands but may also be taken to indicate in ontogenetic fashion the phylogenetic process which has resulted in the derivation of *clemsonae* from *metcalfi*.

While the arrangement suggested above satisfies the situation so far as the majority of known specimens is concerned, two specimens are known that fall completely outside this system. These two examples, U.S.N.M. nos. 127523–4, were collected by H. J. Cole, on Black Mountain, ca. 4,000 feet, Harlan County, Ky. One (no. 127523) is a sexually mature female (snout-vent 56 mm), while the other (no. 127524) is an immature male (snout-vent 39 mm). Both specimens are a uniform rich black above and below, including the chin, throat, and breast, except for a very few tiny, isolated light flecks, and have whitish palms and soles. In both specimens the costal count is 15, and the toes overlap, while the vomerine count is 12–14 in the female specimen and 10–10 in the male. In color and dentition these specimens are indistinguishable from *clemsonae*, except for the uniformly black throat, while the overlapping toes might suggest *metcalfi*. On purely geographic grounds it would be expected that they would fall in the scope of *metcalfi;* that they do not, and appear instead to be more nearly identifiable with *clemsonae*, raises a point of major importance. It is possible that additional specimens from this locality would provide sufficient characteristics to distinguish a separate form. But for the present, the status of these Kentucky specimens is not properly determinable; a reasonable decision as to their identity must await additional material from this critical area.

ACKNOWLEDGEMENTS

Owing to the kindness of Dr. Doris M. Cochran I have had available the extensive collections and other facilities of the United States National Museum; for this, and many simi'ar courtesies, I am in Dr. Cochran's debt.

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ICHTHYOLOGY.—*A new name for* Synchiropus altivelis *Regan, with a key to the genera of the fish family Callionymidae.*[1]

LEONARD P. SCHULTZ and LOREN P. WOODS, U. S. National Museum.

During the course of our study of the fishes of the northern Marshall Islands it was necessary to review the genera of callionymid fishes of the world. We observed that *Synchiropus altivelis* Regan [Trans. Linn. Soc. London 12: 249, pl. 30, fig. 1. 1908 (Seychelles); Norman, John Murray Exped. 1933–34, Sci. Repts. Fishes, 7 (1): 75, fig. 27. 1939 (Gulf of Aden)] is preoccupied by *Callionymus altivelis* Temminck and Schlegel [Fauna Japonica, p. 155, pl. 79, fig. 1. 1845 (Japan)], now *Synchiropus altivelis* (T. and S.). We herewith propose the new name *Synchiropus normani* to replace *S. altivelis* Regan, 1908.

Although Fowler (Proc. U. S. Nat. Mus. 90: 1–2. 1941) gave a key to the genera, new facts have been found that require us to present our different analysis, with synonyms of genera. The species of this family have not been revised, and they are in a general state of confusion, somewhat as a result of the differences between sexes. We do not have the time or the specimens necessary to revise carefully the several dozen species named but believe our analysis of genera will aid in referring most or all of the species to a defined genus. We have examined the 54 lots of types and paratypes of this family along with numerous other nontype specimens in the National Museum. That material forms the basis of the following key:

KEY TO THE GENERA OF CALLIONYMIDAE

1*a*. Two dorsal fins.

2*a*. No pelvic ray free or separate from others, all connected by membrane.

3*a*. Two lateral lines, lower one represented by a fleshy keel or membranous fold along lower side of body beginning opposite anterior base of anal fin; opercular membrane ending in a free flap; posterior part of maxillary semitubular in form, convex side inward, open side outward, with a very short anterior and outwardly projecting concave lobe, scarcely developed in small specimens; opercular opening superior in position, above opercle, in form of a small foramen; pelvic fins connected to pectoral base by a membrane attached opposite base of 4 to 6 pectoral rays from dorsal edge of fin; upper lateral line simple; no orbital tentacle; preopercular spine acute with small spines dorsally and a small antrorse spine basally; soft dorsal and anal rays all unbranched except last one in each fin which is branched to base.....
Calymmichthys[2] Jordan and Thompson

3*b*. A single lateral line located mostly in dorsal part of body, no thin fold of skin along lower side.

4*a*. An orbital tentacle in combination with a broad somewhat fleshy lower lip folded under chin; opercular opening a small foramen above opercle; no free opercular flap; pelvic membrane attached to base of pectoral fin; lateral line simple; preopercular spine acute with spiny points dorsally and an antrorse spine ventrally and somewhat basally; all rays of soft dorsal and anal fins un-

[1] Published by permission of the Secretary of the Smithsonian Institution. Received August 13, 1948.

[2] *Calymmichthys* Jordan and Thompson, Mem. Carnegie Mus. 6(4): 296, pl. 36, fig. 2. 1914 (genotype, *C. zenicus* Jordan and Thompson). Their figure lacks the lower lateral line described twice in the text.

Diacallionymus Fowler, Proc. U. S. Nat. Mus. 90: 29. 1941 (genotype, *Callionymus goramensis* Bleeker).

Dermosteira Schultz, U. S. Nat. Mus. Bull. 180: 267, fig. 26. 1943 (genotype, *D. dorotheae* Schultz); We believe *C. cookei* Günther belongs in this genus.

branched except last one in both fins branched to its base . . . *Amora*[3] Gray

4*b*. No orbital tentacle, or if a small one occurs the lower lip not broadly folded below chin.

5*a*. Pelvic fin membrane absent, no membrane connecting pelvic fin with pectoral base; preopercular spine without a basal antrorse spine.

5*b*. Pelvic membrane present and joined with base of pectoral fin near its middle; no free opercular flap; gill opening a small foramen above opercle; lateral line simple; no orbital tentacle.

6*a*. Opercle ending in a free dermal flap; gill opening in a superior position at rear of opercle; lateral line without elongate side branchings; body very robust; all rays of soft dorsal and of anal unbranched except last one, which is branched to base in both fins . . . . . *Eleutherochir*[4] Bleeker

6*b*. No free opercular flap of skin; gill opening superior in position, above opercle; all rays of anal unbranched except last, which is branched to its base.

7*a*. Lateral line with short branches at right angles; all rays of soft dorsal unbranched except last, which is branched to its base . . . . . *Paracallionymus*[5] Barnard

7*b*. Lateral line simple; soft dorsal rays branched and last one to its base . . . . *Yerutius*[6] Whitley

8*a*. Preopercular spine with a basal antrorse spine or one near its ventral edge; all rays of dorsal and of anal fins unbranched except the last one in both fins which is branched to its base . . . . . *Callionymus*[7] Linnaeus

8*b*. No antrorse spine at base or on ventral side of preopercular spine; first soft dorsal ray usually unbranched, all rest branched (except in young), the last one to its base; anal rays unbranched except last one, which is branched to its base . . . . . *Synchiropus*[8] Gill

2*b*. First pelvic ray not connected by a membrane with the next ray; gill opening behind opercle . . . . . *Dactylophus*[9] Gill

1*b*. Dorsal fin single, spiny part lacking; gill opening superior in position at rear of opercle; pelvic membrane not connected with pectoral base; lateral line simple; orbital tentacle lacking; no antrorse spine near basal part of preopercular spine; soft dorsal rays branched, last one to its base; anal rays unbranched, except last one, which is branched to its base . . . . . *Draculo*[10] *Snyder*

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[3] *Amora* Gray, Illustrations of Indian zoology, Hardwicke, 2: pl. 90, fig. 1. 1833–34 (genotype, *Amora tentaculata* Gray = *Anaora* Gray, *ibid.*, probably typographical error for *Amora* in directions for arranging plates). (Reference copied.) We refer *Synchiropus tentaculatus* Herre (Philippine Journ. Sci. 35: 33, pl. 3. 1928) as a synonym of *Amora tentaculata* Gray. *S. tentaculatus* Herre is a homonym also, but since we do not consider it as distinct from *tentaculatus* Gray, we see no reason to propose a new substitute name. In addition *Callionymus fimbriatus* Herre (Herre Philippine Exped. 1931: 94. 1934) is a synonym of both *tentaculatus* Gray and *tentaculatus* Herre, in our opinion.

[4] *Eleutherochir* Bleeker, Versl. Medel. Akad. Wet. Amsterdam, ser. 2, 14: 103. 1879 (genotype, *C. opercularioides* Bleeker).

Brachycallionymus Herre and Myers, *in* Herre, Proc. Biol. Soc. Washington 49: 12. 1936 (genotype, *B. mirus* Herre = *C. opercularioides* Bleeker).

[5] *Paracallionymus* Barnard, Ann. Mag. Nat. Hist., ser. 9, 20: 69. 1927, and Ann. South African Mus. 21: 448. 1927 (genotype, *C. costatus* Boulenger).

[6] *Yerutius* Whitley, Rec. Austral. Mus. 18: 115. 1931 (genotype, *C. apricus* McCulloch).

[7] *Callionymus* Linnaeus, Systema Naturae, ed. 10: 249. 1758 (genotype, *C. lyra* Linnaeus).

Calliurichthys Jordan and Fowler, Proc. U. S. Nat. Mus. 25: 941. 1903 (genotype, *C. japonicus* Houttuyn).

Repomucenus Whitley, Austr. Zool. 6: 323. 1931 (genotype, *C. calcaratus* Macleay).

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Velesionymus Whitley, *ibid.*: 418 (genotype, *C. limiceps* Ogilby).

[8] *Synchiropus* Gill, Proc. Acad. Nat. Sci. Philadelphia, 1859: 129. 1860 (genotype, *C. lateralis* Richardson).

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[9] *Dactylophus* Gill, Proc. Acad. Nat. Sci. Philadelphia 1859: 130. 1860 (genotype, *C. dactylophus* Bennett = *D. bennetti* Gill).

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